PUBLISHED EVERY SATURDAY BY

THE W. J. JOHNSTON COMPANY, Limited,
167-177 TIMES BUILDING, NEW YORK.
Established 1874. Incorporated 1889.
W. J. JOHNSTON, Prest. C. E. STUMP, Treas. and Bus. M'g'r.
Telephone Call: Murray 586. Cable Address: "Electrical," New York.

T. COMMERFORD MARTIN and JOS. WETZLER, M. E., Editors.
WM. A. ROSENBAUM, Editor Patent Department.
WALTER T. HUNT, Advertising Department.

New England Office, 8 Cook Building, Boston.
W. IRVING BARKER, Manager.
Western Office, 44 Lakeside Building, Chicago.
W. A. NICHOLS, Manager.
Philadelphia Office, 31 City Trust Building.
EDWIN F. CLARKE, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.
(Including Postage in the U. S., Canada or Mexico.)
IN CLUBS of four or more, $2.50 a year each; with a free extra copy to the getter up of a club of 8. Foreign subscription, $5 a year.

In requesting your address changed, give **old** *as well as new address.*

ESTABLISHED **SIXTEEN** YEARS AGO, **THE ELECTRICAL WORLD is the Pioneer Electrical Journal of America, and has well maintained its lead. It has the LARGEST CIRCULATION of any electrical periodical in the world, and is the BEST ADVERTISING MEDIUM.**

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished.
For Sale Notices, Situations or Help Wanted, $1 to $2 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News,** or information relating to any application of Electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.
Matter for the **Editorial** Department should be addressed to
The Editor of The Electrical World, New York.

Subscriptions and communications relating to **advertising** or the **business department** should be addressed to
THE W. J. JOHNSTON COMPANY, Ltd.,
Times Building, New York,
OR ANY OF THE BRANCH OFFICES.

VOL. XIII. NEW YORK, MAY 4 1889. No. 18

CONTENTS.

PAGE.

ILLUSTRATED ARTICLES:
The New Bernstein Lamp and Socket ... 256
The Kapp Regulating Transformer ... 256
The "Portelectric" System of Transportation ... 257
The Bentley-Knight Double Motor Truck ... 258
The Telephone Central Office at Buffalo, N. Y. ... 259
Prof. Elihu Thomson's New Oscillating Electric Meter ... 260
Alternating Current Lighting in London ... 261
The Electric Traveling Crane at the Paris Exposition. By E. W. H. ... 261
A Novel Insulating Cut-out Joint ... 262

CORRESPONDENCE:
A Storage Battery Plant for Nevada. By F. Reckenzaun ... 257

EDITORIAL:
Paragraphs ... 255

MISCELLANEOUS:
Magnetic Viscosity. By T. T. P. B. Warren ... 256
On the Application of Clark's Cell to the Construction of a Standard Galvanometer. By R. Threlfall ... 257
On the Clark Cell as a Source of Standard Currents ... 258
Alternating Current Motors of Messrs. Ganz & Co., Buda Pest ... 258
The September Telephone Convention ... 259
Standard Rules for Wiring Buildings. By H. H. Humphrey ... 260
Short Notes for Beginners in the Electrical Supply Trade. 2. Training and Opportunities. By F. De Land ... 260
An Electrical Novelette ... 260
The Magnetization of Iron at High Temperatures ... 261
Thomson-Houston Electric Roads ... 262
The Electric City of the West ... 262
Spring Meeting of the Magnetic Club ... 262
The Centennial and the Board of Electrical Control ... 263

SPECIAL CORRESPONDENCE:
New York Notes, 263; New England Notes, 263; Western Notes, 264; English Notes ... 264

DEPARTMENTS:
The Telegraph, 265; The Telephone, 265; The Electric Light, 265; Applications of Power, 265; Personals, 266; Miscellaneous Notes, 266; Business Notices ... 266
Our Illustrated Record of Electrical Patents ... 266

NOTICE OF REMOVAL.

Notice is hereby given that in order to obtain greater facilities for the various departments of the business, THE ELECTRICAL WORLD has removed from the Potter Building to an extensive suite of rooms on the ninth floor of the new "Times" Building, next door, and immediately overlooking Park Row, City Hall Square and Nassau street.

THE W. J. JOHNSTON COMPANY, LTD.

Early Publication. OWING to the approach of the Centennial celebration and the work necessary in occupying our new offices in the Times Building, we have found it requisite to issue the paper several days in advance. It will be seen, however, that the issue is one of great excellence, containing descriptions of several important novelties, as well as all the news of the day.

Alternate Current Motors. THROUGH the courtesy of Messrs. Ganz & Co., of Budapest, we are enabled to lay before our readers the results of some interesting experiments which have recently been made by their electricians on a new form of alternating current motor. While we are not informed of the exact construction of the apparatus, the results obtained with it are of sufficient interest to attract attention. Particular stress is laid, and justly so, upon the fact that the work indicated by the voltmeter and ammeter individually is almost equal to that shown by the wattmeter, a concordance which shows at once the efficiency of the machine. It will also be noted that the new type of motor requires but two wires. We hope at no distant day to be able to present fuller details of the machine to our readers.

Notes for Beginners. WE continue in this issue the short notes for beginners in the electrical supply trade, which Mr. De Land has so well placed before our readers. He certainly makes out a very good case when he shows that a young man, who has evinced a taste for electricity, can find no better opportunity of learning its practical applications than in the employ of a good electrical supply house which carries in stock a large number of testing instruments and all the various apparatus which is in daily use in the different branches of electrical application. A training founded on a few years' experience in such a place must indeed be of considerable value to anyone, no matter in what direction his later and cultivated energies may direct him, and we believe that not a few of our prominent electricians have, at one time or another, served an apprenticeship of this sort, which has been turned to good advantage later on.

A Novel Electric Railway. THE old principle of utilizing the sucking power of an energized helix upon an iron core has again been utilized in an ingenious manner in the construction of a system of electric transportation. As described on another page, the consecutive actions of a number of such helices acting upon a magnetic carriage are made to propel the latter at a high rate of speed, and the arrangement by which this is carried out is exceedingly simple. It is interesting to study the operation of fundamental principles in this system. Here, also, the regulation is automatically effected by the counter E. M. F. created by the passage of the carriage through the helices, so that when the normal speed of the carriage has been attained, only so much energy is consumed in the shape of current as is required to keep the carriage at its proper speed. We think it likely that this system of the Portelectric Company will arouse great curiosity and interest, especially in view of the success that has attended the experimental apparatus.

A Novel Electric Meter. THE rate at which Prof. Elihu Thomson brings out new ideas and apparatus, makes one wonder that so much can be done in such a short time, and on the other hand it proves how quickly new ideas may be moulded into shape in the hands of a prolific inventor such as Prof. Thomson is. Not content, it would seem, with the ingenious form of oscillating self-registering meter, constructed by him but a short while since, he has turned his attention to perfecting it by making it indicate not, as it were, the total energy passed through the circuit in the form of current, but to make it read in lamp hours. This he accomplishes by a construction such that not the total current, but the square root of the same is measured at any one instant—since the principle employed in the meter is that dependent upon the heating of an electric conductor. The idea, in itself a most ingenious one, is carried into practical execution by the most simple mechanical arrangement, and is proof again, if such indeed were needed, of the abundant resources of its author.

Operating Electric Roads. THE statistics of electric roads are such as to challenge more and more the notice of street railway men and others interested in urban passenger business. The figures published by the Julien Company, for example, as to their storage cars, are such as to command attention everywhere. The figures that come from President Allen, of the Sprague road at Davenport, Ia., are also very striking. This road has four 14-foot cars, with twin 7½ h. p. motors, and one 10-foot car for transfers. The road went into operation last year, and the following is the result:

	1887. With horses.		1888. With elec.		P. cent. gross incr.	P. cent. net incr.
	Gross.	Net.	Gross.	Net.		
Sept.....	$1,374.79	$474.79	$1,997.15	$997.15	48	110
Oct.....	1,232.47	302.47	1,903.94	1,121.94	54	270
Nov.....	1,131.49	231.49	1,886.06	986.06	66	320
Dec	1,283 14	353.14	2,022.98	1,122.48	59	220

The showing is a remarkable one as to the advantages of electricity, but it can be understood in the light of the statement made about the Omaha Thomson-Houston road, by Capt. Eugene Griffin, to the effect that the fuel per day per car costs only 28¼ cents. In Scranton, as is well known, the fuel costs even less, as the electric roads are simply burning the culm that has been slowly heaping up from the coal mines.

Comic Electricity. THE popular taste for electricity is being evinced in many ways, but one that we have not seen noted hitherto is the tendency of the comic papers to use electrical ideas, phrases and apparatus as the basis of elaborate jokes and pictures. The other week *Puck* and *Judge* had between them no fewer than four electrical sketches. If our esteemed contemporaries propose to go on in this manner, as we hope they do, we would respectfully suggest that they secure the services of some consulting electrician, and then their science will be equal to their other merits. Meantime the fun seems rather forced, for instance, in a picture which represents an old gentleman in an agonized dance because a young hopeful has connected his electric belt with the burglar alarm, or when another old gentleman rolls his bathtub out of a closet by touching a push-button and is horrified to find a naked urchin in it. These are matched, however, by the picture of the stranded actor out West, who, when asked by another how he expects to get home, slings down from his back a kind of trolley which is supposed to fit the ordinary railroad tracks and in some unexplained electric manner carry him safely back to the "Rialto." We mention these little things more in sorrow than in anger.

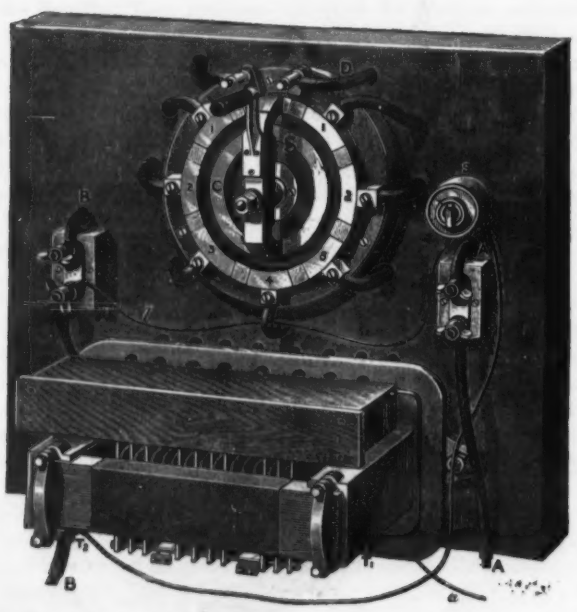
Mayor Grant's Hatchet. It seems a great pity that the Mayor of this city could not have restrained his passion for pole cutting until after the centennial festivities and parades. One sometimes hears of a statesman who is ahead of his party, and this is Mayor Grant's case, for it is evident that he is far more ardent in this crusade than his fellow commissioners, who probably even wish, now and then, for a return of the old days with Mayor Hewitt, stubborn in the other direction. Everybody is wanting to have the streets bright next week, but Mayor Grant is against the slightest concession to the local companies, in spite of the appeals of his associates, and it looks at this writing as though the centennial committees must suffer annoyance, and the public, inconvenience, as the result of his obstinacy. We can respect determination in pursuance of principle and policy, but the general opinion, in which we must perforce join, is that the Mayor is carrying matters to a rather foolish extreme. Even if the companies were offenders, the question is not one that concerns them, but the public as well as the host of visitors from out of town, to whom New York wishes to show her hospitality and her brightest side. With the electric lights out, the streets will be gloomy and the profuse decorations will lose half their effect. If Mayor Grant wants to check the gayety of nations, that, of course, is his business, but we are certainly sorry to find him in such a mood at this time.

The Time fo Standardising. IN his pithy little article on systematic wiring, which we publish on another page, Mr. H. H. Humphrey says: "When electric light fittings have been reduced to standard sizes; when all lamps will have the same bases and fit the same sockets; when shade holders will all fit the same socket and that socket comes universally into use, a great deal will have been done toward making the incandescent light the cheap and common light that it should be." There is solid wisdom in this reflection, and though the time for such uniformity is not yet, it will come. If we could look back into all the details of the history of gas lighting, we should see that the uniformity of standard that now prevails in that system of artificial illumination was not reached all at once, but was a matter of gradual development. But that such standards were made universal should serve as a lesson and a guide to electricians, who tread in many of the steps of their predecessors, the gas engineers. Other fields of industry, too, show the advantages of standards, such, for instance, as those of railroad building and railroad car construction; and these again are paralleled by the standards established in screw threads, piping and the like. We have spoken above more particularly with regard to electric lighting, but our readers will see that the hint will apply to the whole range of electrical manufacture, where we are practically to-day without even a standard for wire sizes. Improvement in this respect cannot come too soon.

Thermo-Magnetism. IN a short note which appeared on this page in our last issue, drawing attention to the interesting experiments on the "Recalescence of Iron," by Dr. John Hopkinson, and its confirmation by Prof. Elihu Thomson, we alluded to the fact that the results obtained might well be applied to improved methods for the construction of thermo-magnetic motors. This view of the question seems to have also been taken by *Industries*, and the article on this subject in another column shows in what direction this improvement may best be realized. It would seem from these experiments that even for a large variation of temperature below the point at which iron loses all coercive force the change in magnetic permeability is but very small; but that in the neighborhood of that point even a small difference of temperature has a marked effect upon the permeability of the iron. The lesson to be derived from this is obvious, namely, that the most economical method of constructing a thermo magnetic motor into which iron enters as the working medium requires that the temperature should be maintained in the vicinity of that point at which the metal loses its magnetic properties entirely, and that it should only vary over a small range either way from that point. With this idea embodied in its construction, the number of alternations of temperature could be largely increased, so that the theoretical efficiency, as well as the efficiency per pound of material of such machines, seems capable of being largely augmented over the forms heretofore employed. Nevertheless, the question of operating upon iron at high temperatures still enters the problem, and it is in this direction that the difficulty of carrying out practically the theoretical considerations will be chiefly met.

The Kapp Regulating Transformer.

One of the most important conditions in any system of central station lighting, is that of keeping the pressure at the points of consumption as nearly as possible constant. With an alternating current supply on the feeder system, the problem can be solved by the insertion of a small transformer into each feeder, which raises the pressure at the station end of the feeder by the exact amount which is lost on the way in consequence of the ohmic resistance of the feeder. The primary coil of the regulating transformer is connected with the terminals of the dynamo, and the secondary coil is subdivided into a number of sections connected with a multiple contact switch. The current flowing to the feeder is led by means of this switch through one, two or more of the sections of the secondary coil, and receives there an additional E.M.F. proportional to the number of sections inserted. The regulating transformer is so proportioned that, when the whole of its secondary coil is inserted, the increase of pressure is just sufficient to make up for the loss due to the ohmic resistance of the feeder. If the current flowing out is below the maximum, the switch is set to some intermediate point, so that in all cases the pressure of the distant feeding end is kept constant. This principle of regulation, which, says *Industries*, has been devised by Mr. Gisbert Kapp, primarily with a view to its application in central station work, is also suitable for regulating the pressure on the lamp circuit in private installations; and the accompanying illustration shows one of these regulating transformers, as fitted to the electric light installation at the town house of Sir David Salomons, Bart., which is supplied with current from the Grosvenor Gallery. The whole apparatus is placed on a board, and fixed against the wall, the transformer occupying the lower part, and the multiple contact switch the upper part of the board. In this particular case it was desired to have means for either raising or lowering the pressure in the lamp circuit, and the secondary coil of the transformer has therefore been divided into seven sections, five of which are traversed by the lighting current in one direction, and are used for raising the pressure, while the remaining two are traversed in the opposite direction, and are used for lowering the pressure. The switch has accordingly seven contacts. When the handle is in the position shown in the engraving, the whole of the secondary coil is cut out, and the pressure supplied to the lamps is that given by the secondary coil of the main transformer, which serves this installation. If the switch handle be moved to the right over the contact marked *I*, the current in the lamp circuit is caused to flow through one of the opposing sections of the secondary coil, and the available pressure at the lamps is reduced by 2 volts. If the switch handle be further moved to the right over contact 2, the second section is brought into circuit and the E. M. F. is reduced by 4 volts. On the other hand, if the switch handle be moved to the left, those sections of the secondary coil in which the E. M. F. is additive are succes sively brought into circuit, each step adding 2 volts to the available pressure at the lamps, so that by moving the



THE KAPP REGULATING TRANSFORMER.

switch handle round to the contact marked 5, an increase of 10 volts over the pressure given by the main transformer is obtained. The connections are as follows: The service leads from the main transformer are brought to two terminals, to which the main lamp circuit is connected. Into one branch is inserted the regulating transformer, connection being made with the cables *A* and *B*. One terminal T_1 of the primary coil of the regulating transformer is connected with one of the main terminals of the supply circuit, and the other terminal T_2 is connected by means of the switch *s* and wire *b* with the cable *P* coming from the other main terminal. The switch *s* is inserted so that the primary can be cut off if the instrument is not required. The cable *P* is connected by a fuse and lead *B* with the inner contact *C* of the multiple contact switch *S*, and the cable *A* is similarly connected with the middle or zero contact of the switch by the lead *D*. The other contacts of the switch are connected with the different sections of the secondary coil in the manner already explained. The advantage of this regulating apparatus is that without appreciable loss of energy, and by merely setting the switch to one or other of the contacts, the brilliancy of the lamps throughout the whole house can be regulated, while the regulating power is the same whether only a few lamps or the whole of the lamps in the house are alight. A rheostat or a choking coil could be used to lower (though not raise) the available pressure, but the effect would in either case be influenced by the number of lamps in use at any time. With the apparatus above described, the increase or diminution of pressure is, however, quite independent of the number of lamps in use, and the consumer is able to burn his lamps with either a higher or lower voltage than that supplied from the central station.

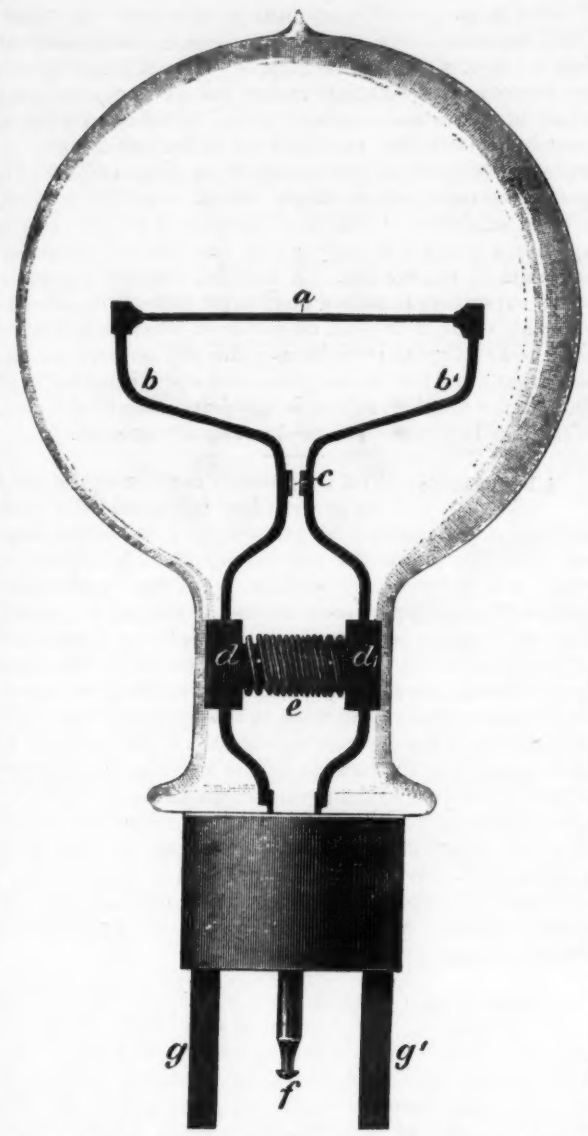


FIG. 1.—NEW BERNSTEIN SERIES INCANDESCENT LAMP.

A somewhat similar apparatus, called a "compensator" in station work and "house regulator" for isolated work, has been designed by the Westinghouse Electric Company in this country, and both these apparatuses were described in our issue of Oct. 27, 1888.

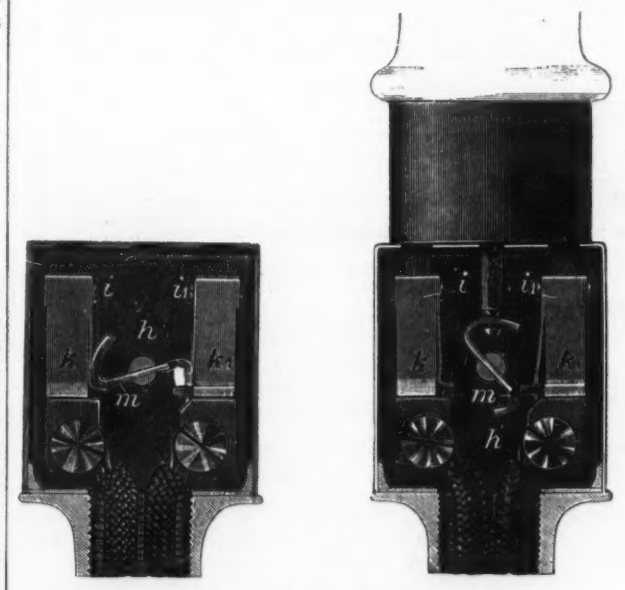
The New Bernstein Lamp and Socket.

As our readers may be aware, Mr. Alexander Bernstein was among the first who advocated the running of incandescent lamps in series instead of in parallel arc, and up to the present time he continues to be one of the strongest advocates of this system, on the ground of simplicity and economy, both in the distribution network and in the central station apparatus Mr. Bernstein believes that constant current can be maintained far more easily and economically than constant potential. We have from time to time described various forms of lamps designed by Mr. Bernstein, all of which, it will be remembered, were provided with a thick carbon in the place of the form usually employed. Mr. Bernstein has also devised a number of cut-outs the object of which is to maintain the continuity of the circuit if by any accident the carbon conductor of the lamp be broken or fail.

One of the latest forms of lamps constructed at the works of Mr. Bernstein, at Hamburg, Germany, is shown in the accompanying illustration, Fig. 1. Here, it will be noted, the incandescent body is a straight carbon rod, *a*, which is connected to the leading-in wires, *b* and *b'*. These wires are bent in such a manner as to almost touch each other at the point *c*. Two insulating sleeves, *d* and d_1, embrace the leading-in wires, and are drawn towards each other by a spiral spring, *e*. As long as the carbon rod *a* remains perfect, the wires are prevented from touching each other at the point *c*. If a flaw, however, be developed in the carbon conductor, so that the carbon is consumed at that point, the spiral spring draws the two wires slowly together until they make contact at the point *c*, when, evidently, the lamp is short circuited. These lamps are made in sizes varying in illuminating power from 16 to 50 candles, but they are also made for larger illuminating powers, though Mr. Bernstein leans toward the opinion that it is better to employ a number of lamps of smaller illuminating power than a single one of large power, for reasons which will be readily understood.

A special socket has also been constructed for this lamp, which is illustrated in Figs. 2 and 3. Referring to Fig. 2 there will be seen two sleeves *i*, i_1 fixed to the plate of insulating material *h*, and into these sleeves the square plugs *g*, g^1 of the lamp fit. In order to obtain a good contact between the plugs and the sleeves the front sides of the latter consist of two flat springs *k* k_1; the circuit wires are attached by means of the screws shown. The switch, *m*, which is of S-form, can be turned from the outside, and serves to short-circuit the lamp. As shown in Fig. 2, the lamp is short circuited. In order to obtain a good contact between the switch *m* and the metallic sleeves *i*, i_1, two flat springs are employed, the one to the left being bent at the bottom, as shown. The spring *k*, mentioned above, has a pin attached to its lower end, which prevents the turning of the switch *m* in that direction, so that no opening of the circuit can take place. When, however, the lamp is inserted in the socket the flat springs *k* and k_1 are raised, the pin attached to k_1 is thown out of contact with the switch *m*, so that the latter can turn into the position shown in Fig. 3, and in that position the current passes through the lamp. In this condition, however, the lamp cannot be removed from the socket, because the S-shaped switch *m* embraces the head of the rod *f*, which is attached to the lamp socket. But the current can be turned on and off the lamp at will.

If it is desired to remove the lamp, the switch *m* must again be turned into the position shown in Fig. 2, by which the short-circuiting is effected in the lamp socket. In another method of construction sometimes employed by Mr. Bernstein, the leading-in wires act as the spring itself, so that the latter becomes superfluous; both forms, however, work equally well.



FIGS. 2 AND 3.—NEW BERNSTEIN SOCKET AND SWITCH.

Magnetic Viscosity.

BY THOMAS T. P. BRUCE WARREN.

When experimenting on the magnetic permeability of oils and other liquids, I found that if a magnetic substance, like soft iron, be covered by different liquids, not only was its susceptibility modified by the permeability of the intervening medium, but distinct evidence was obtained in every case of a molecular stress being produced in the medium, and which indicated itself by a decided tendency of a balanced magnet to stick, as it were, when it was allowed to remain a short time over the soft iron.

The explanation seems to be that the maximum effect of a magnet on soft iron depends on the rapidity with which the medium accommodates itself to the constrained condition necessary for the soft iron to take its greatest degree of magnetization.

As time is an element of importance in attaining a full maximum magnetization from any magnet of a certain intensity, it is not unreasonable to suppose that when a *non*-magnetic medium has been so constrained by the lines of force passing through it, the molecular stress, which is also favorable to an increased magnetization of the soft iron, will retain the magnet with a slight but decided extra force. I propose to call this extra force, which is due to molecular stress, *viscosity*.

Viscosity is more probably a function of permeability. We have the magnet acting across the medium to the soft iron, and conversely the soft iron reacting through the same medium to the magnet, until the molecular arrangement of the medium accommodates itself to a maximum.

If a galvanometer needle, suspended in the usual way, be forcibly deflected by a current, it is found that the needle regains its fiducial position very slowly. This has been attributed to a crushing effect on the fibres. This

effect has been called viscosity. I do not think it is entirely due to mechanical causes. The term as used in this communication is applied to a very similar phenomenon.

The experimental arrangement was as follows: A balanced horseshoe magnet was suspended from one of the arms of a balance. Immediately under the magnet was placed a shallow specimen glass (salver) with the usual flat glass cover. The cover prevented the magnet being wetted with the liquid, and allowed the attraction to be balanced through a uniform depth of liquid. The soft iron rested on the bottom of the glass.

When the magnet was allowed to rest on the cover for a short time, it required a greater weight being placed in the other pan to pull the magnet off than when the magnet was momentarily in the same position, or only for so long as to restore equilibrium in the balance.

I propose giving some experimental results on a future occasion, and to point out its importance as an adjunct to analytical research.—*Chem. News.*

The "Portelectric" System of Transportation.

It has more than once been said, and probably with truth, that the standard of a nation's civilization may be well gauged by the perfection of its methods of communication. Indeed, everything that will increase the facility with which communication can be had between persons in different cities, or in the same city, must tend to an increase in the amount of business done, and again, in the comfort which the dwellers in cities may enjoy. Of the various methods which have been proposed for transportation within cities, the direct application of steam is necessarily limited, and electricity has unquestionably shown itself to be the ideal power for such traffic. Electricity has even to-day taken such firm hold that in one form or another it is certain to displace every other system. Without describing, however, the various methods by which electricity can be applied to schemes of transportation, we would call the attention of our readers to the ingenious system designed by Mr. John T. Williams, and now being brought out by the Portelectric Company of this city.

The principle of this system is a very simple one, and consists of the well-known sucking action that a helix or coil exerts on a rod of iron when placed near its centre. Thus, if a bar of iron or steel be placed with one end near the centre of a helix, on passing a current through the latter, the bar will be drawn in and maintained in a central position as long as the current continues. If now the current be broken the bar will again be free to move, and if we imagine a second helix placed in a position similar to that which the first occupied with relation to the bar, then, on the passage of the current through the second coil, the bar will be drawn toward that one and out of the first. With a number of helices arranged side by side, and an arrangement for making and breaking the current at the proper time, it is evident that a bar of iron could be moved continuously in any desired direction. Such, in fact, is the system of Mr. Williams, which he has carried out in practice in a neat manner.

Our illustration, Fig. I., shows, in perspective, a road which is intended to carry a small car for the transportation of small packages and letters. This rests upon a single rail and is guided by a small upper rail and the two upper flanged wheels. The body of the car is constructed of light steel, shown complete in Fig. 2, and the object of this construction will be made apparent presently. The car is arranged to pass between a continuous line of wire coils, which, of course, are completely covered and protected from the weather. The function of these coils and their operation will be readily understood from the examination of Fig. 3, which shows one of them with the covering removed so as to expose the contact arrangement by which the current is made and broken at the proper time.

As stated before, the track constitutes one side of the

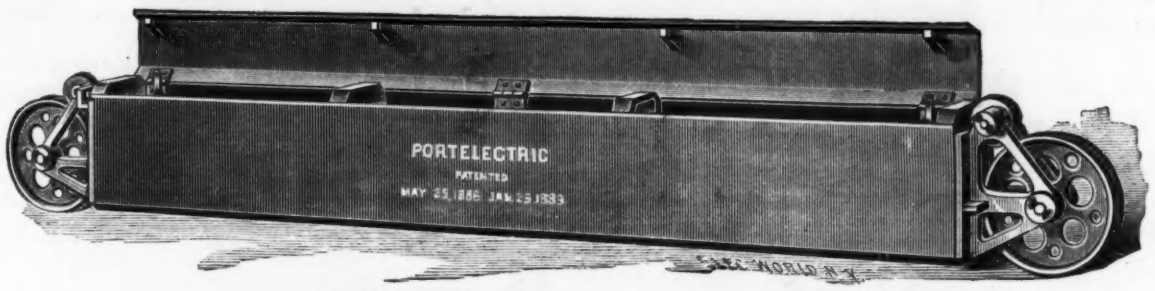


FIG. 2.—STEEL CARRIAGE FOR "PORTELECTRIC" SYSTEM.

circuit, which is connected through each helix to a contact point C, and the other side of the main line conductor, L, is connected to the pivoted magnet NS, whose function is to make and break the circuit of the helix at the proper time. This is accomplished as follows: As remarked above, the car body is made of steel, which is magnetized. Thus, assuming the front of the car to be the S-pole, the arrangement is such that just as the carriage is about to enter the helix, it repels the S-pole of the pivoted magnet NS, forcing it upward and bringing the N-pole down in contact with the contact point C. This closes the circuit through the helix, which therefore tends to draw in the car with a sucking action. This contact at C is maintained up to the time that the centre of the carriage arrives at a short distance from the centre of the helix, when the influence of the carriage on the magnet NS becomes neutralized and the contact is broken. It is evident that if the contact were maintained after the carriage had passed the centre of the helix the action would be to retard the motion of the carriage, and, indeed, to stop it entirely.

The object of breaking the contact a short distance before the centre of the carriage reaches the centre of the helix is to avoid the retarding effect upon the carriage which would be experienced on account of the extra current of breaking in the coil. This extra current, being in the same direction as the main current, would tend to drive the carriage forward as long as it was behind the centre of the helix; but it will be readily seen that if the carriage had passed the centre, the extra current would tend to retard it in the same way that the main current would.

It will thus be noted that each helix comes into action successively and only one is in action at any one time, so that the current is utilized to the best advantage. It will readily be understood that when once the carriage is in motion and its inertia has been overcome, comparatively little force will be necessary to maintain it at speed, and this is shown to be the case in the present system. As a consequence, the strength of the coils may be considerably diminished after a short distance from the terminal station, as the power required is diminished accordingly when the carriage has arrived at the proper speed. Another interesting fact in connection with the system which we have had occasion to observe, and it must necessarily follow from its construction, is that the current in the helices is considerably cut down by the counter E. M. F. generated by the passage of the carriage through them, so that in a certain sense the system is self regulating to maintain the carriage at its proper speed.

A system of this kind must necessarily be provided with means for stopping the car gradually and without jar at a terminal station, and this has been worked out very ingeniously by Mr. Williams. The brake consists of a helix similar to those shown, which is provided with a contact that, unlike the others, remains closed after the carriage has passed the centre of the helix. The effect of this is that the car is retarded or pulled back, and it is astonishing to witness how rapidly a brake of this kind brings the car to a standstill. The system, which we have seen in operation, seems well adapted to the transportation of packages and letters and all purposes of that character.

On the Application of Clark's Cell to the Construction of a Standard Galvanometer.*

BY PROF. R. THRELFALL.

A standard Clark cell having large electrodes together with a known platinoid resistance are used to standardize a reflecting galvanometer, constructed with a single movable coil sliding in guides so as to vary the constant in known proportions. Two controlling magnets are carried on opposite sides of a sleeve sliding on a central tube inclosing the long fibre, and a small hollow copper cylinder in oil acts as damper. The tangent law was found by calculation to be practically correct up to 15°, and the scale is curved so as to read tangents on a scale of equal divisions. To give this result the approximate polar equation to the curve is shown to be $r = f(1 + 207\,\theta^2 + .0260\,\theta^4)$. In standardizing the instrument a known current is sent through it from the Clark cell, and the controlling magnets adjusted till the spot comes to a fiducial mark on the scale. By varying the position of the coil currents ranging from .001 to .4 ampère can be measured.

A Storage Battery Plant for Nevada.

To the Editor of The Electrical World:

SIR: As a little news item from the Pacific Coast we take pleasure in stating that this company has been awarded a contract for a complete 100-light plant with storage batteries (E. A. Co.'s) for the State Insane Asylum at Reno, Nev., the dynamo to be operated by water power from the Truckee River, in the vicinity of which the asylum is located. The contract was given after a careful inspection of the storage battery system of the Electrical Accumulator Company, made some time ago in the East by Mr. J. L. Stevenson, son of the Governor of Nevada. At present a gasoline plant is in use, which, however, is considered dangerous and unsatisfactory, and the accumulator system was decided upon as being the only electric light system that displaces gas in a thoroughly practical manner. The above is the first plant to be installed by the Pacific Electrical Storage Company, who are now preparing to push the business on this coast to the utmost extent.

PACIFIC ELECTRICAL STORAGE COMPANY,
SAN FRANCISCO, Cal. F. RECKENZAUN.

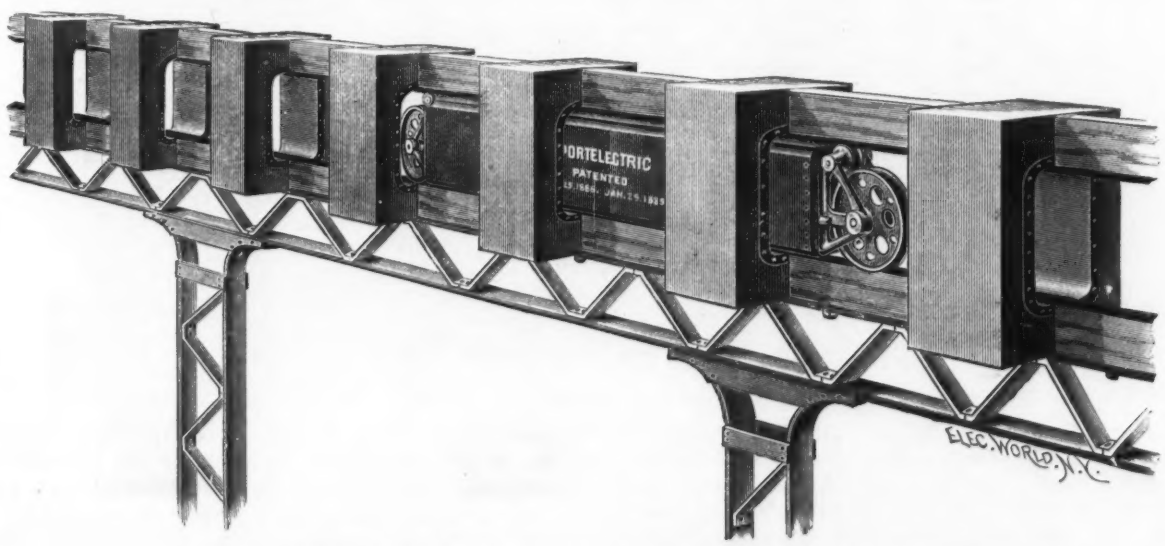


FIG. 1.— PORTELECTRIC" SYSTEM OF TRANSPORTATION.—PERSPECTIVE.

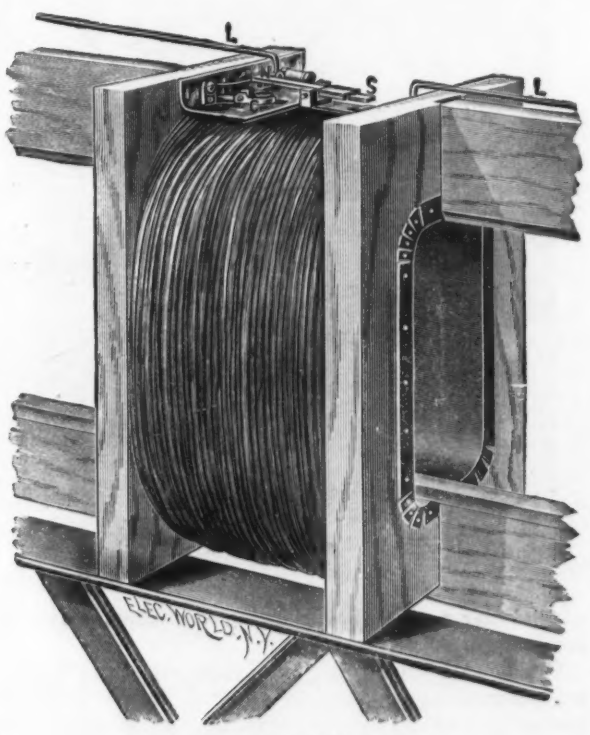


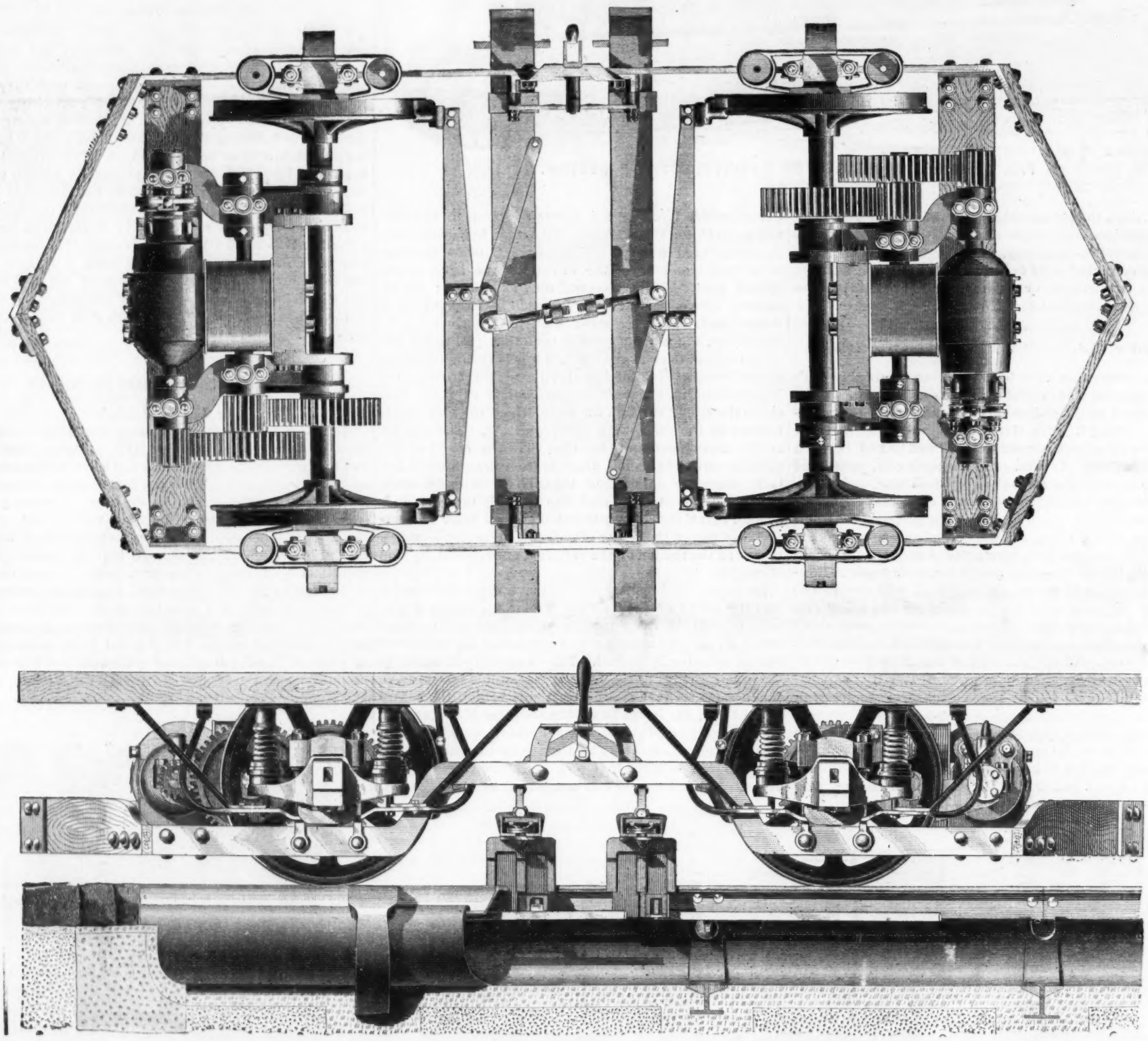
FIG. 3.—ENERGIZING COIL.

Cowles Patents in Germany.—According to the London *Electrician*, the Cowles patents for the manufacture of aluminium alloys by electricity have been upheld by the German courts. This decision is the outcome of an action for the revocation of these patents, which was recently brought forward by Dr. H. Kunheim, of Berlin, who relied on the anticipations of Sir W. Thomson (1879), Benzon (1858), Faure (1882 and 1883), and John Calvert (1856). The Heroult process, which is employed at Oerlikon, is not, so we are informed, patented in Germany.

* Abstract of a paper read before the London Physical Society, March 23, 1888.

New Bentley-Knight Double Motor Truck.

The accompanying illustrations show the construction of the Bentley-Knight Company's new standard double motor truck, each motor being of 15 h. p. These are the heaviest trucks yet built and operated for electric tramway service, and are an improvement upon those which have for the past year and a half been in operation on the Observatory Hill Passenger Railway, at Allegheny City, Pa., equipped by the Bentley-Knight Company. Trucks, such as here illustrated, are now running on the West End Street Railway Company's line in Boston, where they pull two cars every day, and three cars on Sundays, being adapted equally well for use with either elevated conductors or with the conduit system. In the engravings they are shown equipped for use with the conduit, of



NEW BENTLEY-KNIGHT DOUBLE MOTOR TRUCK.—SIDE VIEW AND PLAN.

which latter a side view, showing construction and all necessary attachments, is given.

The motors shown are fitted with every appliance to insure simplicity of parts and economy and durability in commercial use. Their insulation has been carried to the highest possible point and all parts are interchangeable. The truck is entirely independent of the car-body and goes under any ordinary car without cutting or alteration, and without lifting the car above its ordinary height. Control of the car is effected by a single lever at the front platform, having a play of something over a foot. The car is reversed instantly by the throwing of a handle attached to the box containing the lever above mentioned, and it is constructed so that the reverse cannot be applied without first automatically cutting off the current.

A special feature of the Bentley-Knight construction is the manner in which the motors themselves, together with all their gearing, are supported outside of the space between the axles of the car, thereby giving the greatest ease in getting at all wearing parts, whenever necessary, and also enabling the motors to be carried in the position where they are least in the way and least exposed to the splash of mud and water from the wheels. The spring support given each motor makes the wear on the working parts and on the trucks extremely light, while allowing the motors to have a yielding impact on the load at starting.

Cut gearing is used throughout, and as all journals are held in rigid castings the gearing is practically noiseless at all times. The commutator brushes are fixed in position when the motor is first tested, and thereafter need no adjustment either for change of load or direction of rotation.

While the Bentley-Knight Company has carefully investigated the question of conduit construction, and has laid and operated a successful conduit system, it does not confine its attention to that system. The Bentley-Knight Company has now in operation an elevated conductor road which has stood the tests of two winters with success, namely, the road at Allegheny City, Pa. The grades, curves and general difficulties of that road, are, we believe, greater than those of any road which has so far employed electricity. In Boston, the Bentley-Knight motors, while running over three miles of conduit, are also employed over 12 miles of elevated conductors.

This company has lately taken the contract for the Port Chester, White Plains & Tarrytown Street Railway, crossing Westchester County, upon which line heavy double motor trucks will be employed, in order to meet the steep grades and constant curves of this line. Each of the cars to be sent to this line is guaranteed to tow another car after it at 15 miles per hour. This line comprises, in all, 12 miles of elevated conductor, which will be partly suspended across the roadway from poles at the curb, and partly operated from elevated conductors bracketed off from poles set at the side of the street.

"A Non-Conductor" is the title of a sensational story just begun in the N. Y. *Evening World* about a man who was "executed" by electricity, and who came back to consciousness several hours after the authorities had, as they supposed, carried out the sentence.

On the Clark Cell as a Source of Standard Currents.

In a paper by Prof. R. Threlfall and Mr. A. Pollock, read before the London Physical Society on March 23, the authors find, contrary to ordinary ideas, that Clark cells can be used to send currents of considerable magnitude without the E. M. F. being appreciably changed, and have constructed cells which give .001 ampère steadily for half an hour. This result has been obtained by increasing the size of the cell so that each electrode is about 5 square inches in area, and the internal resistance is about 6 ohms. For the ordinary small test tube cell, the resistance of which may be about 1,500 ohms, the current ought not to exceed .00001 ampère. On closing the circuit the potential difference drops almost instantaneously to its steady value, and when the circuit is opened rises equally rapidly to very nearly the original E. M. F. The cells completely recover in time. If the current sent be too large the potential falls for a time, and afterwards rises and tends towards a fixed value. In this respect Clark's cells are greatly superior to large Daniells sending current through the same resistance. The paper contains several tables and curves as well as valuable results respecting the close agreement between the E. M. F.'s of a great number of different cells.

Alternating Current Motors of Messrs. Ganz & Co., Budapest.

For some time past, electricians working in the department of distribution by means of alternating currents have sought to obtain a motor which could be connected directly to the electric light circuits and which should approximate to the continuous current motor in regard to regulation and economy. The problem which presented itself involved a number of difficulties. In the first place, the efficiency of such a motor appeared to be far below that which is attained in the continuous current motor, and secondly, with certain types of alternating

motors the maintenance of constant speed with varying loads is unattainable. The great drawback consisted in the fact, that if such a motor actually absorbed, say, 5,000 watts of electrical energy on, say, a 100 volt circuit, the ammeter would show, not 50 ampères passing into the motor, but probably 150; *i. e.*, that the motor apparently consumed about three, or more, times the actual number of watts absorbed. This appeared to be a great drawback to the application of alternating current motors, as it entailed an enlargement of the conducting wires, and, indeed, an increase in the size of the transformers, dynamos, etc. This condition of affairs existed when Professor Ferraris published his ingenious experiments, which were paralleled by the motors of Mr. Tesla and others.

Recently the firm of Ganz & Co., of Budapest, have undertaken the construction of alternating current motors, and their electricians, Messrs. Zipernowski, Déri and Bláthy, after experimenting for four years on various types of machines, have succeeded in constructing a practical form. Through the courtesy of the firm we are enabled to publish the following table which gives some details of the new machine. A study of the table will show that the improved result obtained is, that the relation of the apparent energy consumed in the motor, *i. e.*, the energy measured by means of the voltmeter and ammeter, in volt-ampères, is almost equal to the actual number of watts as measured by means of the wattmeter. This ratio of unity between these two quantities shows that the efficiency of the motor is very high. It must be noted that the apparatus upon which these experiments were made was merely an experimental one in which high efficiency was not the principal object sought for; on the contrary, the tests were made with the idea of obtaining some solution of the problem of how to obtain the greatest efficiency. Besides that, the machine was not run at its normal rate of 750 revolutions per minute, but at a lower one. These tests have led to the firm conviction that the efficiency of alternating current motors will eventually be brought up to that of the continuous current. In the new machine but two circuit wires are employed.

Revolutions per minute.	Work of alt. curr. motor.		Apparent energy consumed, volt-ampères.	Actual energy consumed.		Ratio between actual number of watts consumed and apparent number of volt-ampères.	Commercial efficiency in per cent.
	H. P.	Watts.		Watts.	H. P.		
600	15	11,000	18,000	15,800	21.5	0.88	77.0
700	19.8	14,600	24,200	18,600	25.2	0.77	78.5
730	30.4	22,400	29,800	27,700	37.6	0.92	80.9

The September Telephone Convention.

In the last issue of the bulletin of the National Telephone Exchange Association, Gen. Barney says:

"The Executive Committee of this association has decided, by the unanimous vote of its members, that the next meeting of this association, which is to be held in Minneapolis, Minn., shall commence on Tuesday, September 10, at 11 A. M.

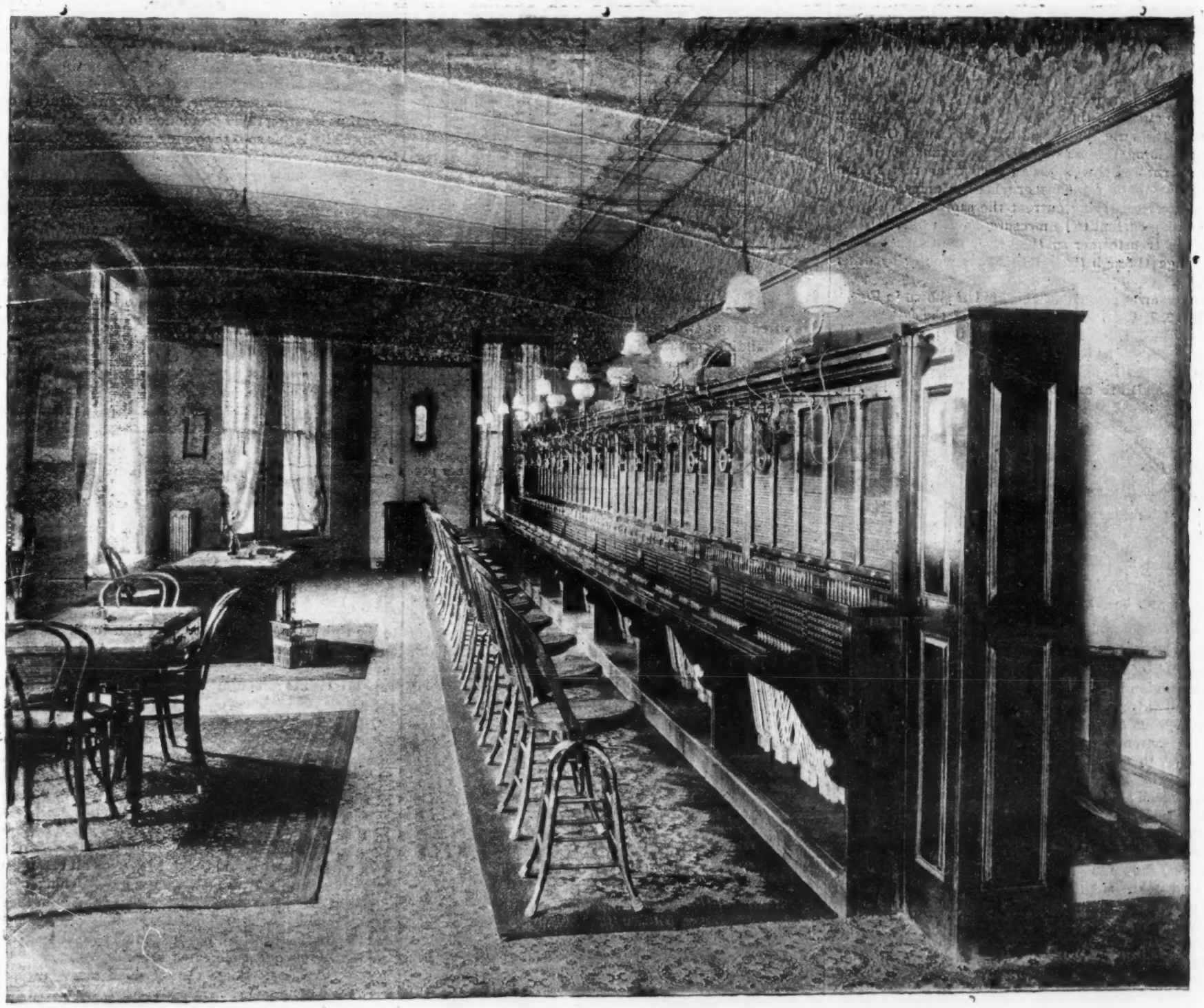
"Negotiations are pending for a special vestibule train, with dining and other conveniences on board, to convey the delegates from the Eastern States, which it is proposed shall run through without change, from New York to Minneapolis, on limited time. Delegates from New England, from this vicinity, and from all parts of the East are requested to wait until further particulars are made public, before making transportation arrangements.

"The September meeting of the National Telephone Exchange Association will be held at the West Hotel, Minneapolis, at the date mentioned above. The hotel is on the American plan, and the rates to delegates will be $3 and $3.50 per day, the latter price including room with bath. This is a substantial reduction from the regular prices of this house, which is one of the finest in the country."

The Telephone Central Office at Buffalo, N. Y.

The telephone companies of this country have of late done a great deal of creditable work in the erection of new office and exchange buildings, and the equipment of apparatus of the latest design and furthest degree of perfection. The improvements in this respect in this city, as well as those in Chicago, Boston, Louisville, Pittsburgh, and elsewhere, with others in contemplation and soon to be carried out, are of the best class, and must give the public a favorable idea of the enterprising spirit and good taste of those who have the control and direction of the telephone service in the leading cities.

The fair city of Buffalo is not behindhand in the development and betterment of its telephone facilities, and in evidence of this fact we have much pleasure in giving on this page an illustration of the beautiful new operating-room in the fine building of the Bell Telephone Company, of Buffalo, of which corporation Mr. H. M. Watson is president, Mr. E. J. Hall, vice-president and general manager, and Mr. H. C. Palmer, secretary and treasurer. For convenience of arrangement and refined æstheticism of appointments and upholstering, the room is one that it is difficult to match anywhere through the land. It is almost needless to say that the installation of apparatus was made by the Western Electric Company, and that it is a finished specimen of beautiful and honest workmanship. The plant comprises a multiple board of six sections having a capacity of 1800 wires, and one extra section for toll lines.



The Electrical World.

OPERATING ROOM OF THE TELEPHONE EXCHANGE, BUFFALO, N. Y.

The Sprague Patents Abroad.—We are informed that an English company has been formed to work the Sprague electric traction patents in Great Britain and Ireland.

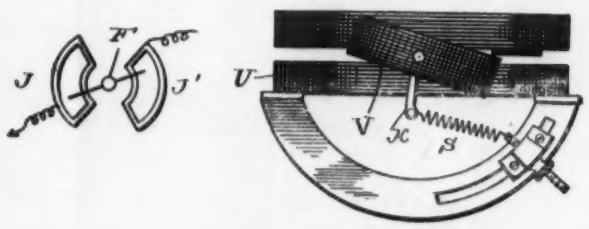
The Engineers' Club, at 10 West Twenty-ninth street, was formally opened at 9 o'clock on Saturday evening, April 27. It is a purely social club, gotten up for mutual pleasure by representatives of the mechanical, mining, civil and electrical branches of this profession. It has already about 300 members, including a large number of well-known men.

Prof. Elihu Thomson's New Oscillating Electric Meter.

About a year ago we described in these columns* an ingenious electric meter of Prof. Elihu Thomson, the indications of which are effected by the oscillations brought about by the transfer of a liquid from one bulb to another by means of vaporization caused by a conductor which is heated by the current. Our illustration, Fig. 1, will recall to our readers the principle of the apparatus, but it will be noticed that in the form here shown the liquid is not transferred bodily from one bulb B to the other bulb B^1, but passes over in the form of vapor, which condenses, and thus finally overbalances the weight of the bulb, which is being heated by the current, for the time being.

We desire, however, to draw particular attention to an interesting modification introduced into the present form of meter. It is obvious that in the first form described the effect is to produce an evaporation which is as the square of the current in the coil, because the heating effect is as the square of the current and is proportional to the time of flow. The effect desired is, however, one proportional not to the *square* of the current, but (in the case of a meter) *directly* to the current itself which is to be measured; and to obtain a correction in this respect, so as to produce a registry in direct proportion to the current flowing on a lamp or power circuit is the object of the new meter. This correction is attained by passing currents through the meter in direct proportion to the *square roots* of the currents in the circuit of the lamps, so that whether one lamp or a dozen be in use the record shall be true. One way of accomplishing this with a fair approximation in the case of alternating currents is to supply the meter from the secondary of a transformer whose primary connects with the circuit carrying current the same as, or proportional to, the current to be measured, and to arrange the coils of the transformer so that their inductive relation may change through their mutual reaction or by other means.

A general arrangement of this kind is shown in Fig. 1, and Figs. 2, 3, 4 and 5 show a number of the details. As shown in Fig. 5, U is a fixed coil placed in the circuit with the lamps used by its terminals t t'. Mounted on a vertically-pivoted shaft, delicately poised, is a second coil V, whose terminals are carried through J J' to the heating



FIGS. 4 AND 5.—THOMSON'S NEW ELECTRIC METER.

coils H or H' of the preceding Fig. 1. The coil V is, however, capable of rotation on its vertical axis F, Fig. 3, and to avoid friction its terminals dip in mercury cups J J', Figs. 3 and 4, from which cups connection is made. A delicate spring S, shown in Fig. 5, adjustable as to its fixed extremity both in position and elasticity is attached to an arm K, extending, as shown, from the coil V or its supporting axis. The spring S is wound conically and is of very light wire, and is adjusted to pull in such direction, and its elastic force is made such, that alternating currents in coils U will, when coil V is circuited through H, Fig. 3, cause deflection of V from the position shown in Fig. 5 to the position at which its plane approaches a right angle with that of coil U, and at the same time that the current induced in coil V by those in U shall be as the square roots of the currents in U. This condition is found to be attainable with tolerable approximation to accuracy by suitably proportioning the restraining influences governing the motion of the coil V under the deflective actions exerted.

The object is, evidently, to so adjust the parts and their relations of size and effect that the currents induced in coil V by currents in U shall always be in proportion to the square roots of the currents in U. If the coil V did not deflect, the currents in it would be in direct proportion to those in U. The deflection of V, however, causes the desired diminution.

Professor Thomson has also applied the method to the direct registration of continuous currents. For this purpose a variable shunt V, Fig. 6, or other means of controlling the flow of current to the lamps, as, for instance, the heating-coil H, is employed. The variable shunt may be operated by a solenoid-core C, or other device responsive to the flow of current in the circuit. The arrangement is so proportioned that increments of current in U will vary the shunt at V, or the resistance at V in shunt to H, in such way that H shall receive only the square roots of the current in the circuit. The variations are, however, not so smooth and delicate as they are with alternating currents in the arrangement above described.

A variable resistance, or resistance whose amount can be set or varied, may be added as a shunt around the coil U, as in Fig. 1, to standardize the readings of the meter. So arranged, the apparatus will register in proportion to the number of lights used and the time of use.

* See THE ELECTRICAL WORLD, April 28, 1888.

Standard Rules for Wiring Buildings.

BY H. H. HUMPHREY.

The excellent communication by Mr. C. H. Crockett in the last issue of THE ELECTRICAL WORLD is full of interesting suggestions. As an example of a building wired in accordance with a number of his standard requirements,

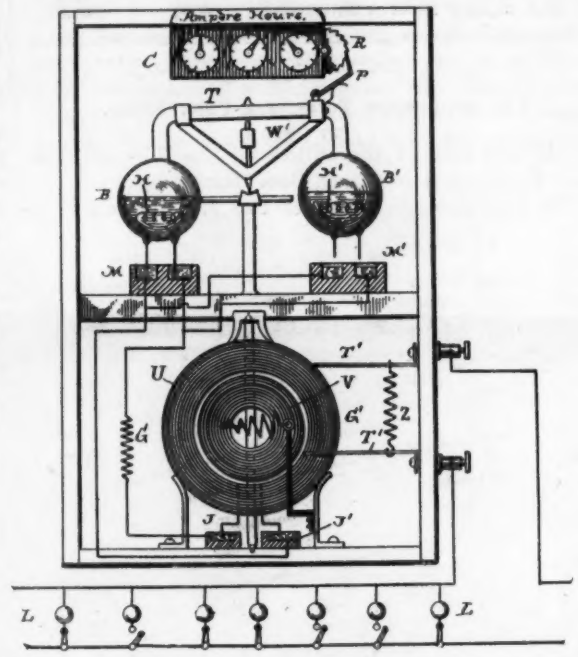


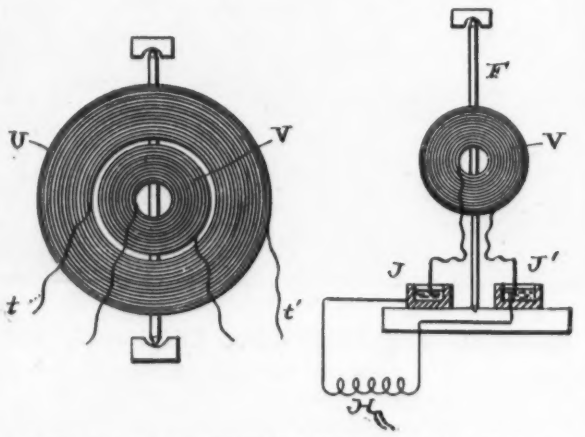
FIG. 1.—THOMSON'S NEW OSCILLATING ELECTRIC METER.

I wish to describe a small office building in Buffalo that was wired about two weeks ago.

This building consists of four floors of offices, exactly similar to one another in every respect. It is wired for twenty-six 16 c. p., 50-volt, 1 ampère lamps to each floor. The distribution could have been made as good, and the wiring cheaper, had it not been that the gas pipes had already been fixed (the building is being changed over from a large hall on each floor to suites of offices), and the floors were torn up for them, and also that the owner preferred that the gas and electric meters be all located at one place. The wiring is all concealed, and combination fixtures will be put in. The tenant taking an office can have his choice of gas or electricity, and have whichever meter he prefers put up.

Each floor is wired separately and will be on a separate meter at present; but the owner of the building, believing that the day of small meters is in the near future, has had arrangements made so that a separate meter can be put upon each office. The one lavatory and three hall lights on each floor, and three lights in the boiler and pump room in the basement, are on a separate circuit that will feed through a meter on the third floor. These will be paid for by the landlord, and hence his desire to have them separate.

The loss in this wiring is 2½ per cent. from entrance of building to lamps with full load, viz., 1½ per cent in the



FIGS. 2 AND 3.—THOMSON'S NEW ELECTRIC METER.

main and 1 per cent. in branches. The length of the main is 40 feet. Hence, 22 (lamps) × 40 (feet) × 28 (constant for 1½ per cent.) = 24,640 c. m. The nearest gauge number is No. 6 B. & S. The length of the first branch is 32 feet to centre of group of 5 lights; 5 × 32 × 42 = 6,720 c. m. = No. 12 B. & S. The other branches are respectively No. 14, No. 14, No. 12 and No. 14.

The constants that I have used, 28 for 1½ per cent., and 42 for 1 per cent., are based upon the value 10.5 ohms as the resistance of one mil-foot of copper of 98 per cent. conductivity, which may be rather large, although I find some authorities give a still larger value.

Mr. Crockett's suggestion of using the 3 wire system is a good one, although in as small an installation as this, the saving in copper would not amount to much, and would be more than counterbalanced by the additional labor of running a third concealed wire.

A uniform system of wiring as regards the size of conductors, percentage of loss, and quality of insulation, is very much to be desired. Of not less importance is uniformity of sockets, shade holders and other fixtures. Any one connected with central station work is familiar with the vexations attendant upon, and the trouble experienced in getting shades and holders to fit the particular style of socket that he may be inflicted with. It is encouraging to notice the tendency among the promoters of "the best," but, as yet, small systems, to adopt the socket and lamp of some well-known type, instead of introducing their own ingenious but troublesome articles. When electric light fittings have been reduced to a standard size, when all lamps will have the same bases and fit the same sockets when shade-holders will all fit the same sockets and that socket comes universally into use, a great deal will have been done toward making the incandescent light the cheap and common light that it should be.

Short Notes for Beginners in the Electrical Supply Trade.

BY F. DE LAND.

2. *Training and Opportunities.*

For a young man just starting out in life there are few branches of business offering greater inducements to enter than the supply trade, for though it is hardly out of its infancy its growth is marvelous, and a grand future is certain, thus insuring rapid promotion to the right men.

Especially is this so if the young man has shown a fancy for electricity, been dabbling in experiments, taken an elementary course or two at school, and earnestly desires to extend his knowledge. The position of salesman in a large wholesale and retail supply house is replete with advantages and opportunities not to be gained elsewhere except at a great outlay of money.

See what knowledge respecting all the new and important testing instruments can easily be gained! Several houses are carrying from one thousand dollars to five thousand dollars worth of standard apparatus. Then there are the different publications received as fast as issued, and all the prominent electrical journals, all the late improvements in telegraph and telephone apparatus, electric light supplies, house goods, etc.

In fact, a large supply house can serve as a grand school

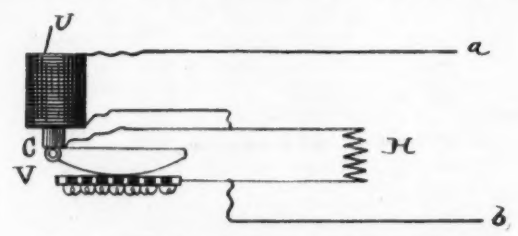


FIG. 6.—THOMSON'S NEW ELECTRIC METER.

to the right man, practically fitting him to fill responsible and remunerative positions in his line. And how quickly these important positions will be offered to him—if he only establishes a reputation for knowledge, activity and capacity.

Ofttimes a salesman may be annoyed and irritated at the seemingly foolish questions asked, but if they are rightly answered the customers good-will is retained and the day's returns are increased.

Then again, these seemingly foolish questions may serve a purpose in spurring an ambitious salesman on to more thorough study in order to answer sensibly and definitely any questions propounded, and to teach his inquirer exactly what he desires to learn. Of course all this will require time and patience and more or less burning of the midnight oil. But the reward comes quickly in the increased interest awakened in further study of the science and also in the increased respect shown by the customers and in the consequent increased sales.

And right here is where the salesman must be careful not to feel discouraged should his employer not show *his* appreciation of his clerk's increased value by a timely addition to his salary. Let him keep right on and strive all the harder to solve the many problems presented, wasting but few of his precious moments and biding his time, for the day will surely come when he can command his own salary in some leading supply house. Good, competent and steady electrical supply men are not picked up every day; in fact, they are scarcer than are good men in any other line of business, and they easily command from twelve hundred to two thousand dollars per year.

An Electrical Novelette.

The following is clipped from the New York *Herald*:

The novelist laid down his pen with a satisfied air. He was writing a story of the twentieth century. "I think that chapter will go," he said to himself. "The old Chicago millionaire lies in his chamber, dying of wounds inflicted by a burglar the night previous. Before his bed stands a mirror connected with wires and electric batteries. Close at hand is a telephone. There are lawyers and detectives in the room.

"The bell rings.

"'Hello! Hello! Who is it?'

"The answer comes that it is the Central Police Office, New York. They have a suspicious stranger in custody, arrested on the arrival of the early morning pneumatic train from Chicago.

"Close to the dying man's ear the receiver of the telephone is placed. A look of terror comes into his eyes as he gasps:

"'That is the very voice!'

"Then a surly looking countenance, not that of any one in the room, appears reflected in the mirror.

"'The—man—who—killed—me!' comes in spasmodic utterance from the victim's lips, as he falls back upon the pillow, dead."

Alternating Current Lighting in London.

For several weeks past a Board of Trade inquiry has been in progress in London on the granting of provisional orders for electric lighting to a number of companies.

FERRANTI CONDUIT WITH CONCENTRIC CONDUCTORS.

During a recent session Mr. Ferranti, electrician to the London Electric Supply corporation, stated that the excavations at Deptford covered about 200 feet square, and the company had put down buildings and chimneys for 40,000 h. p. Of that there was now under steam 6,000 h. p. The remainder of the plant was being put down. There were two sets of engines, each capable of generating for 25,000 lamps. The horse-power at present arranged for would supply 250,000 lights, and they had contracted for further machinery, which would increase that number to 450,000 lights. He saw nothing extraordinary in the 5,000 horse-power engines they were having, and now that he saw how steamships had gone ahead, he was sorry the company had not got a larger engine. Of the 250,000 lights he had mentioned, it was proposed to work up to only 150,000, leaving a margin to facilitate repairs, and to provide against failure of supply through accident. They were laying down six mains, two of which would be brought to Cannon street, two to Blackfriars Bridge and two to Charing Cross. They were concentric conductors, and were laid from Deptford to London Bridge, and then separated in the manner described. They were carried on cast iron brackets on the railway, and would be thoroughly insulated. Each main would carry a supply for 10,000 10 c. p. lights, and they were so designed that any one of them could be thrown into connection with any of the engines at Deptford in the event of the breakdown of an engine. The tension in the mains was 10,000 volts, but by the converters that would be reduced to 2,400 volts. The transformers in each distributing station were divided by the two mains, each of which thus had two different kinds of current, part from one dynamo and part from another. The supply was therefore duplicated, and if one main failed the other would have ample capacity to supply the whole demand. At the distributing stations the converters would be worked approximately up to their normal power, but they found by experience that for a short time they could work them up to twice their normal power. If one failed it would be cut out by its own fuse automatically. These converters lowered the potentials to practically one-fourth of what was started with. Each distributing station would practically be a small Grosvenor Gallery, with the advantage of a very perfect duplicated supply.

The loss in the Deptford mains would be about one-fifth per cent. of the energy per mile run; so that if there were five miles of trunk there would be a loss of one per cent. If there were short circuiting or imperfect insulation between the outer and inner copper, the only evil would be that the conductor would not be of use for conveying the current, but the external effect would be practically nothing. It would not hurt any one to touch them when at full work. The insulating capacity of these mains had been tested very severely. He had tested them repeatedly up to one million volts without getting through or injuring the insulation; with the pressure they were working at that would give them a safety margin of 100 to 1, which was enormous in a case like this. This system was, in his opinion, perfectly safe in every respect—safe externally from the station, and as safe internally as moving machinery could be.

The illustration shows a sketch of the ordinary conduits for the concentric conductors.

The Magnetization of Iron at High Temperatures.

The short paper which Dr. John Hopkinson communicated to the Royal Society,* says *Industries*, deals with a subject which has hitherto been but imperfectly understood, and which may have some important practical applications. The usual opinion as regards the magnetic properties of iron at high temperature is that the metal becomes less and less magnetic as the temperature rises, until at a red or white heat it is absolutely non-magnetic. Dr. Hopkinson's experiments prove that this view is only correct for the two extreme conditions of the iron, viz., at the ordinary temperature and at red or white heat; but that at intermediate points the magnetic behavior of the iron cannot be expressed by any continuous law, the magnetic permeability depending partly on temperature and partly on the intensity of the magnetizing force, or more correctly speaking, on the induction. He found that for a small magnetizing force and an induction below 3,000, the permeability at high temperatures is far greater, and its rate of variation with temperature is far greater, than was commonly supposed. The practical application of this discovery which will immediately suggest itself to electricians, is that of the more direct conversion of heat into electrical energy. Edison, Menges and others have constructed thermo-electric machines in which the rapid heating and cooling of the iron core of the armature was intended to produce induced currents in the coils wound over the core, the energy being supplied, not in the form of mechanical power, but in that of heat. Hitherto the designers of such machines have always striven to make the difference of temperature between the cold and hot part of the armature core as large as possible, and the great difficulty has been the fact that iron does not absorb and lose heat with sufficient rapidity. Now, it would appear that only a small difference of temperature is required to produce a very great change in the magnetic condition of the iron, and as the action of such machines depends entirely upon the change in the magnetic condition of the armature core, it is possible that Dr. Hopkinson's discovery may be utilized in improvements whereby thermo-electric generators may become practical machines. Briefly stated, the discovery is the following: The permeability of iron for a magnetizing force of 4.0 rises very slowly from about 2,500 to 2,800 as the temperature is increased from 8.5° C. to about 600° C. For a further increase of temperature the permeability rapidly falls to 1 at 737° C. Here we have a fairly large change in the permeability for a difference of temperature of 137° C., but the behavior of iron when a smaller magnetizing force is used is still more remarkable. From a diagram given in Dr. Hopkinson's paper, it appears that when the magnetizing force is .3 the permeability slowly rises to about 1,400, when the temperature is increased from 8.5° C. to 640° C. For a further rise of temperature the permeability increases at a very fast rate, reaching 11,000 at a temperature of 727° C. But with a further rise of temperature the permeability decreases, almost suddenly reaching 1 at 737° C., so that in this instance it appears that we have a change in the permeability from 1 to 11,000 with the very small change of temperature of 10° C. There should be no difficulty in constructing a thermo-electric machine in which this small change of temperature takes place with sufficiently great rapidity to produce powerful inductive effects; and if the discovery of Dr. Hopkinson should be confirmed in actual practice, there seems thus a fair prospect that thermo-electric generators may become practically successful.

* See THE ELECTRICAL WORLD, April 27, 1889.

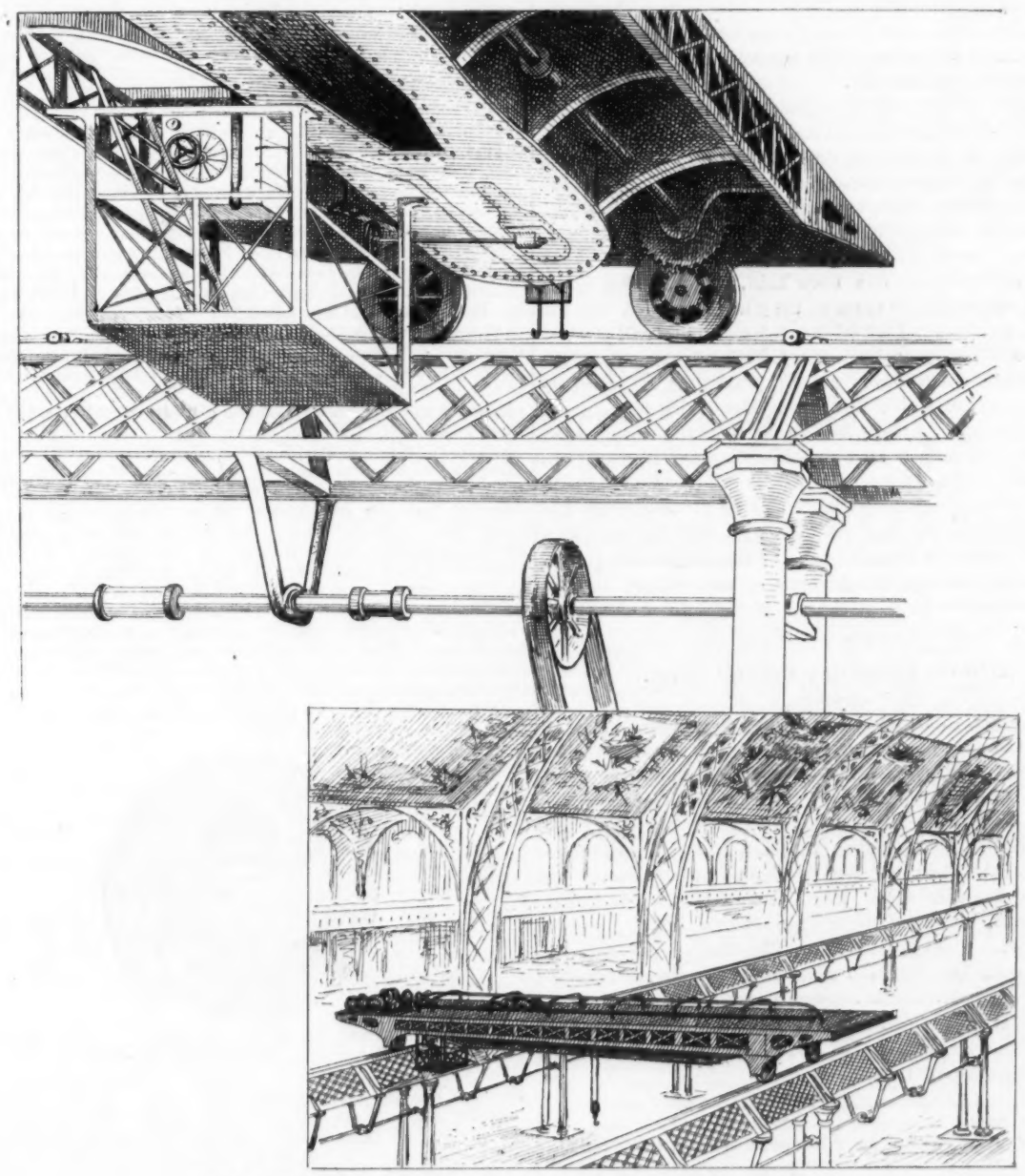
The Electric Traveling Crane at the Paris Exposition.

(*From our Special Correspondent.*)

PARIS, France, April 12, 1889.

In laying the plans for the Paris Exposition, it became very evident to the administration that means must be devised for handling material as it came into the machinery palace and setting in position the heavy machinery and apparatus of the exhibitors. Many plans were made, but out of the many it was at last decided to make use of the supports made for the counter shafting and to put in a large traveling crane.

The lines of shafting, running the entire length of the building, are sixty feet apart, and are so placed that all



TRAVELING ELECTRIC CRANE, PARIS EXPOSITION.

the machinery in the hall can be run from them. Substantial iron pillars, on good foundations, are set up at intervals of about fifty feet, capped by a well-braced structure, from which the hangers are suspended, while on the apex of this triangular support is a steel rail. As will be seen from the illustrations, each pair of shafting-supports constitutes a track, on which runs the traveling crane. Bon, Lustrement & Co., the largest makers of this class of machinery in Paris, were given the contract for the crane, and no expense has been spared to make the apparatus fulfil all requirements.

The frame of the bridge is 65 feet long and 10 feet broad; it is 32 feet above the floor and 8 above the shafting, and very strongly and solidly built. To be up with the times, the motive power is electrical; a Gramme series-wound dynamo, type No. 7, run as a motor and develop-

ing about 12 horse power, operates the crane. By an ingenious gearing, the motor not only moves the bridge from one point of the track to another, but lifts or lowers the load, moves it by a 4-wheel truck from one end of the bridge to the other, or performs all these operations at once. The power is transmitted from the motor to the lifting and traveling mechanism by a system of friction gearing owned and installed by the Compagnie Electrique (Gramme) who have also done all the electrical work here necessary.

The surfaces of the pulleys are covered with a leather facing, and as the relative positions of the pulleys can be regulated at will, so can the tractive power of the pulley.

The hand-regulating rheostat, the switch and ampèremeter, and all the levers for starting and stopping and manipulating the machinery, are concentrated inside a "cab" just large enough to accommodate one man, placed underneath and at one end of the bridge, so that the operator can see each movement necessary, and have the means at hand to execute it.

The method employed in connecting the motor with the generating apparatus is very simple, and resembles the one employed in numerous electric roads in America. Two copper cables, .4 of an inch in diameter, are stretched tightly on either side of one rail, being supported on large porcelain insulators. These are picked up by two brass hooks, under the motor, through which the cables slide as the bridge moves back and forth. Connection is made from here to the rheostat and ampèremeter, and from there to the motor. Underground connection is made between the cables and the source of power by means of well insulated wires drawn through a clay-pipe conduit.

The generating plant is on the south side of the building, inclosed in a small brick structure of its own. It consists of a 25 horse power Westinghouse automatic engine, running at 325 revolutions, belted direct to a 50 ampère Gramme dynamo, type No. 7, working automatically at an E. M. F. of 350 volts. The dynamo runs at a speed of 750 revolutions per minute.

The crane is designed to handle 15 tons, and the ease with which it carries around some of the large castings is wonderful. It works with tantalizing slowness, however, and makes an abominable amount of noise. Although the experiment has not been tried, it is estimated that it would require nearly an hour to travel from one end of the building to the other at its present speed.

It was intended, as has been said, to have this crane ready to handle all the cases as they were brought into the building, but from a lack of what we would call *push* or *enterprise*, it has just been completed, when many of the heavy pieces of machinery are in place. It is very convenient now, but would have been more fully appreciated a few weeks ago. Exhibitors groan over the price asked for its use—six dollars an hour—but they pay it, nevertheless.

When the exposition opens, and there is no further use for the crane for placing machinery, it will be used as a passenger transport from one end of the machinery palace to the other. A very comprehensive view of all the exhibits can thus be had. E. W. H.

A Novel Insulating Cut-Out Joint.

We illustrate in the accompanying engravings, Figs. 1 and 2, a novel insulating cut-out joint, designed and patented by Mr. H. M. Doubleday, of the Marr Construction Company, Pittsburgh, Pa. Practical workers in incandescent wiring will appreciate the efforts of the designer in attempting to combine an insulating joint with a cut-out in a neat and compact way. Fig. 1 illustrates the insulating cut-out joint, complete, as in practical use. Fig. 2 shows the same with the cap removed, illustrating the cut-out arrangement, the latter being made single or double-poled, as desired. These cut-out joints are manufactured by Mr. H. T. Paiste, of Philadelphia, Pa., the well-known maker of the Paiste electric switch, recently illustrated and described in our columns.

Prof. George Forbes on European Central Stations.

Our English correspondent writes as follows under recent date: Prof. George Forbes gave us recently the results of his recent tour of inspection of the principal central lighting stations in Europe in a long and interesting paper read before the Institution of Electrical Engineers. He remarked that the one thing wanted by electrical engineers in this country was practical experience of central station lighting, and he expressed a hope that they would not be too proud to learn a lesson from those who have been engaged in this particular branch of work both in America and on the continent. Prof. Forbes divided his paper into two parts, the first describing the three chief stations in Europe, namely those at Berlin, Milan and Rome, and the second discussing the lessons to be learnt from these stations. Berlin is supplied on the low tension direct-current system, as originally developed by Edison, except the arc lights, which are on a high pressure circuit. The three stations in this city supply in all nearly 40,000 16 c. p. lights, besides 144 15 ampère arcs. Rome is supplied altogether, both for arcs and incandescents, on the transformer system. Prof. Forbes was of the opinion that this station was the finest example of an alternating current central station which he had ever seen. It supplies at present 9,000 16 c. p. incandescents and over 200 arcs. The greatest distance to which the current is sent is three miles, and Siemens concentric conductors are used throughout. Another interesting point in connection with this station is that the machines are all capable of working in parallel. Milan is worked by Thomson-Houston arcs, and by both low pressure currents and high pressure alternating currents for incandescents. This station supplies 14,000 16 c. p. incandescents and 350 arcs. A Siemens ratchet arc lamp, taking only 4.5 ampères, is largely used in Milan.

In the second part of Prof. Forbes' paper he said that he foresaw great danger in the enormous extensions of electric lighting which were about to be undertaken in this country, unless, as he again remarked, our engineers paid greater attention than they had hitherto done to the lessons to be derived from experience both in Europe and in America. He then proceeded to criticise in detail many points in which English practice differed from that

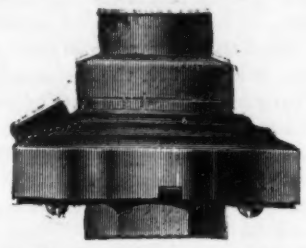


FIG. 1.—A NOVEL INSULATING CUT-OUT JOINT.

which obtains elsewhere. He called attention first to the fact that in the low tension systems now at work in this country, in no single case was the three-wire system employed, and moreover, there had been a general neglect to establish feeders. He recommended that feeders should be divided into two or three groups, those in each group having the same length and the same loss of pressure. When the station was at full load, the dynamos working feeders should be worked at a higher pressure than those connected with shorter feeders, while when the load is light all the dynamos would work at the same pressure, because the loss in the feeders would be insignificant. I am not aware that this system is actually in operation anywhere, but in certain cases it is probably worthy of consideration. Turning to high pressure alternate current distribution, which, by the bye, Prof. Forbes insists on calling the "Gaulard Gibbs system," he insisted that when the mains extended over several miles the employment of feeders was just as necessary as in low-tension distribution. The neglect of this precaution in London had already become painfully apparent in the case of the Grosvenor Gallery station, where the outskirts of the district were supplied with a very inefficient light. He then called attention to the device of the Westinghouse Company for ascertaining the fall of potential upon their high-tension circuits. With regard to the all-important question of insulation, he said that experience both in Berlin and in Rome had showed that lead-covered cables were not altogether a success. After a time, if at any point there has been a slight defect in the lead and moisture has crept in, voltaic action takes place between the lead and the copper, speedily leading to fatal results. At Berlin, he believed there was some intention of trying a modification of the system of bare conductors, which was already in use by Mr. Crompton at Kensington. He thought that perhaps it would be possible to use oil insulators, in which case he thought that the system would be highly efficient, although rather expensive to lay down. At the present moment it seemed to him that the only types of underground cable that had proved suitable for permanent work were either bare copper run on insulators, or else vulcanized India rubber, or perhaps okonite. Speaking of transformers, he maintained that as a general rule their efficiency was much lower than was usually supposed. There was an idea that practically any transformer would have an efficiency of from 90 to 95 per cent. He should be much surprised if the average efficiency of those most in use in this country exceeded 70 per cent. He advocated the use of higher frequencies, combined, moreover, with a higher peripheral speed of the dynamo. In these matters he thought that the Westinghouse Company had adopted a very excellent standard. As regards working alternators in parallel, there could be no doubt that this could be done, though for his part he did not regard it as essential; subdivision of the mains was in most cases far more practical and had many advantages, as, for instance, when, owing to an outbreak of fire or other causes, it was necessary to cut out a portion of the circuit. The last subject dealt with was the question of automatic or hand regulation. In all low pressure systems that he had examined the regulation was effected by hand, and where the saving in attendance was not very great, he thought it was unadvisable to trust to automatic "dodges." In the case of alternate current dynamos with iron in the armature, where the self-induction was large it was absolutely necessary to introduce an automatic appliance, because the potential varied so rapidly with the current. On the whole, he preferred the method used by Ganz & Co., of regulating large changes by hand and smaller changes automatically. Finally he remarked that the low price of gas in England, the cheapness of coal and the relative cost of labor, all introduced special features which must necessarily cause English practice to differ to some extent from that of the continent of Europe or of America.

FIG. 2.—A NOVEL INSULATING CUT-OUT JOINT.

Thomson-Houston Electric Roads.

The Thomson-Houston Company have been obliged to greatly increase their facilities in order to handle their rapidly increasing business in electric railways. In addition to the large contracts which they closed some time ago, they have lately closed the following:

Lynn & Boston Railroad Company, Nahant Line. This line has 4,369 feet of track, two turnouts, maximum gradient of 4 per cent. The line will extend from Central square, Lynn, to Nahant House, Nahant. One car will be put in operation at first, the power for which will be obtained from the station of the Lynn Electric Light Company.

Newburyport & Amesbury Horse Railway Company, Newburyport, Mass. This line is about six miles in length, and will operate two cars. It is made up almost entirely of curves and grades, the maximum of which is 10 per cent. The cars will be operated by a current from the Newburyport Electric Light Company, Newburyport, Mass., and also the Amesbury Electric Light Company, Amesbury, Mass.

The Newton Circuit Line, Newton, Mass. This line will operate 10 cars, and is 8 miles in length, maximum gradient of 5 per cent. It will run from Newton to Watertown on the West End track, and on new track from Watertown to West Newton and Newtonville.

The Plymouth & Kingston Railway Company, Plymouth, Mass. This line is four miles in length, and will operate three cars. The maximum gradient is 6 per cent. The line will run from Chiltonville through Plymouth to Kingston. On nearly all of the line the bracket method will be used. The track is about laid.

The Quincy Street Railway, Quincy, Mass. This line will operate 4 cars and is 5 miles in length. It extends from Quincy through Wollaston Heights and Atlantic to the Neponset River. The bracket method of overhead construction will be used.

The company has also received orders for new cars from the Wheeling Railway Company, Wheeling, W. Va.; West End Street Railway Company, Boston, Mass.; Topeka Rapid Transit Company, Topeka, Kan.; Omaha & Council Bluffs Railway and Bridge Company, Omaha, Neb.; Lynn & Boston Street Railway Company, Lynn, Mass.

The company has also constructed a track of about one mile for the Hillside Coal Company, at Scranton, Pa., on which a 40 h. p. mining locomotive is used. This is used for carrying coal, and is capable of hauling about twenty cars loaded with one ton each.

The Electric City of the West.

There is probably no city in the Western States which has reached such a prominence in electric railway matters, or has become renowned so much for its varied and extensive use of electricity for power purposes as the City of St. Joseph, Mo. This city was one of the first to adopt electricity upon its street railroads for motive power, and on its Union Passenger Railway demonstrated the manifold advantages of electric power for propelling street cars. After this railroad had been running some time, another railway in this city, the Wyatt Park line, installed a complete equipment of electric cars, which have now been running about six months. The success of these two lines has been striking. They have become very popular with the citizens of St. Joe on account of their speed, reliability and ease with which they are kept under control; and land in the vicinity of these roads has greatly increased in value, owing to their good service.

There only remained two other railways in St. Joseph which had not yet adopted electric power, and these two railway companies, through their presidents, during the last week, have contracted with the Sprague Electric Railway and Motor Company, which furnished the equipments for the other two St. Joseph roads, for the entire equipment of their lines. This last order amounts to 20 cars and over 10 miles of track. Since the Union Passenger and Wyatt Park lines have been in operation they have been so extensively patronized that each of these companies has ordered additional equipments of five and nine cars respectively. These orders now make 44 electric cars which are now in operation, or have been ordered for the city of St. Joseph alone, with nearly 25 miles of track.

In addition to this remarkable showing in electric railway matters, the city of St. Joseph has shown a very pleasing amount of enterprise in installing stationary motors, very many of which are in operation in the city in use for all kinds of industry, and their number is very rapidly increasing. St. Joseph is only an example of the advantages which the use of electric power brings with it, both in rapid transit and better service to the general public, as well as reducing operating expenses to the railway companies, in the case of electric railways, and greater ease of operation in the case of the users of stationary motors.

Spring Meeting of the Magnetic Club.

At its spring meeting held at Martinelli's, Fifth avenue, and Eighteenth street, Wednesday evening, April 24, the Magnetic Club gave an informal reception. About eighty of the members and their friends, many of whom were ladies, were present. A most agreeable entertainment was provided, which was opened by an exhibition of the phonograph by Messrs. Hatch and Frisbie.

The round, sonorous voice of Mr. McAneeny, who sang into the transmitter a rollicking sea song, was reproduced with excellent effect, and much amusement was caused by the curious results of changing the speed of the reproducing adjustment, which first transformed the manly baritone into a high tenor, and then into a generally demoralized, ragged and lopsided falsetto.

After this there was some vocal and instrumental music, and a graceful and characteristic speech from the well known telegraph veteran, Mr. J. D. Reid. Music and recitations then followed, and some most praiseworthy renderings were given by the large number of talented amateurs that the club had succeeded in bringing together. Among the contributors to the programme of the evening were Miss Vatet, Miss Wilmarth, Mrs. Tomlinson, Mrs. Fox, Miss Stephenson and Miss Lillie Thorpe; Messrs. McAneeny, Wilmarth, Beatty, Donoghue and Ballantine.

At eleven o'clock a collation was served, after which Mr. Casey made a happy speech, in which he commended

the new departure of the club in inviting ladies to its meetings, a step which he considered would be a further justification of the title of the club.

The guests thoroughly enjoyed themselves, and separated at a late hour. The zealous president, Mr. Charles Bruch, is to be congratulated on organizing such a pleasant reunion, and also on the continued success of the club, whose roll of membership is full.

The Centennial and the Board of Electrical Control.

At the meeting of the Board on the 24th, the chairman of the centennial celebration committee made an application for leave to string temporary wires along Broadway, so as to facilitate the arrangements in carrying out the parade. Commissioner Gibbens explained that the permission sought for was only temporary, and the question to be considered was whether the procession would not move better for having means of communication all along the line. Arrangements had been made by the Brush Company to use an electric lamp at the junction of Broadway and Fifth avenue, and by running a wire from there to the poles in Madison Square, the park could be lighted on the nights of the celebration.

The MAYOR said he was not willing to concede the permission asked for, as he would then have to withdraw the order he had given the day before. Before considering the matter further, however, he wished to ask the representatives of the different companies how many wires they had strung without permits since April 15. He did not wish to interfere in any way with the centennial celebration, but if the companies were tobe allowed to go on stringing wires just how, and when, they pleased the Commission was useless, and he for one should retire. He had been informed that a number of wires had been illegally run by various companies since April 15, and he was determined to grant no more permits until the companies had proved that they intended to behave better in the future. He then questioned the representatives of the Manhattan and Brush companies, who were present, on the subject of the illegal wires, but the information elicited was not as full as he desired, so the expert was instructed to find out who the owners of the wires were and to report at the meeting of the Board on the following day.

Commissioner GIBBENS was strongly in favor of granting a permit to the centennial committee, and asked the Mayor whether he would appoint a committee of three—to consist of the Mayor, one member of the Commission, and the superintendent of lamps and gas—to decide how the temporary lighting of Broadway, Fifth avenue and the parks, during the celebration, could be best done. The Mayor said he would oppose the granting of a permit to any companies which had violated the rules of the Board. President Moore, of the Brush Company, said he would give a pledge that his company would hereafter act in accordance with the instructions of the Commission. With considerable warmth the Mayor replied: "I think that of all the companies that have violated the rules, your company is the most culpable offender. Not only did you oppose the efforts of the Board to put the wires underground, but when the order was given to remove the poles and wires you turned on a strong current on the Fourteenth street circuit which seriously interfered with the work and might have caused the death of some of the workmen. It is as serious a thing as I have ever heard of, and I am not in favor of granting any permits whatever to your company until they have been properly punished for it."

Commissioner GIBBENS said: I think, Mr Mayor, we should not punish the centennial committee for the faults of these people. The committee wants to make the celebration as complete a success as possible, and one of the chief features should be the illuminations. Don't let us stand in the way of the success of the centennial, even for the sake of punishing the refractory companies."

It was decided to defer the answer to the centennial committee to the following day.

The removal of signal boxes along Broadway, reported by the police as obstructions, was ordered.

A paper from Mr. Wm. Maver, Jr., on the insulation of underground conductors, was ordered to be placed on the minutes.

The Board met again on Thursday at 11 o'clock. The report of the expert showed that some of the charges to which the attention of the Mayor had been drawn were without foundation and others were not fully confirmed. In some cases the charges of illegal stringing of wires were substantiated.

The MAYOR said: "I want to announce it publicly so as to prevent any further misunderstanding, that Mr. Wheeler informs me that in some instances he has had people arrested for violating the rules of the Board, and taken before a police magistrate, who simply reprimanded and then discharged them. Now I desire to give public notice that should any case of this kind occur in the future, I wish to have the information brought to me, and I will bring the matter to the attention of the Grand Jury. It is not a wise thing for the expert and engineer of this Board to go with cases of this kind before a police magistrate, and then for us to allow the irresponsible stringing of wires to be continued."

Commissioner GIBBENS suggested that authority be given to Mr. McCormick to issue permits to electric light companies to put up temporary wires during the centennial celebration. The Mayor was in favor of giving the lighting to such a company only as had not acted contrary to the rules of the Board,

The United States Illuminating Company was the only one, therefore, that it ought to be given to, and he should vote in its favor. Mr. Gibbens remarked that possibly this company could not light all the places where lights were wanted.

The MAYOR alleged that it was well known that the companies were all in one big combine, and said that what one could do any of them could do.

A committee was finally appointed, consisting of the Mayor, Commissioner Gibbens and Superintendent McCormick, which should have power to grant lighting permits for the duration of the centennial celebrations, the preference to be given to the United States Company. Mr. Stewart was given permission to light the arch at Fifth Avenue and Washington Square for ten days.

The secretary was directed to return to the President of the Western Union Telegraph Company certain applications for permits, and to inform him that the Board would decline to consider any such application until the company should carry out its agreement to take down its poles and wires along the line of the elevated road, made when it received permission to string cables on the elevated structure.

An application from the Metropolitan Telephone and Telegraph Company for permission to string housetop wires from the Western Union building at Broadway and Twenty-third street, to supply customers in the Fifth Avenue Hotel, the Hoffman House, and other buildings along Broadway, was laid over.

The application from the United States Company to string temporary wires on Fourth avenue and other streets was referred to the special committee.

The Board then adjourned.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, April 27, 1889.

Washington Carbons.—Holmes, Booth & Haydens, 25 Park Place, have lately taken the selling agency for the Washington carbons for arc lighting. These carbons are given a good reputation for long life and evenness of burning.

Harlem, N. Y.—The station of the Harlem Electric Light Company, at East 124th street, with all its Waterhouse and Fort Wayne Jenney apparatus, etc., was totally destroyed by fire on April 25. The fire is said to have started on the third floor, origin unknown.

The Electric Club will, I hear, make arrangements to accommodate about thirty visitors during the Centennial celebration. As hotel quarters have long ere this all been pre-empted, electrical people from out of town will find this a great convenience. The club will have table d'hote dinners every day from 6 to 9 P. M., and the spirit of good feeling will prevail.

The Gibson Electric Storage Battery Company, have, I understand, secured an enormous factory at Chatham, N. Y., where they will at once begin business. It is 350 feet long and 45 feet wide, and has a stone boiler house, 45 feet by 45. It was formerly occupied by Theron Butterworth. The factory has two 100 h. p. boilers, and two 100 h. p. engines, as well as two water wheels, aggregating 60 h. p. In a short time the factory will be the scene of busy activity.

Mr. C. R. Dean, of Curtis & Dean, 115 Broadway, representing the Thomson-Houston Company in this section of the country, reports an excellent trade in all the various lines of arc and incandescent lighting apparatus, motors, etc. They have just sold a 300 light machine, with lamps, for the *Tribune* building, being an addition to the old plant. Another recent order is one for 200 lights from the Jewell Milling Company, of Brooklyn. They have also a large number of small orders on hand.

The Elektron Manufacturing Company reports that the demand for the Perret motors and dynamos, which they build has been far larger than they anticipated, and the consequence is that they have been obliged to make a considerable increase in their manufacturing facilities. They hope soon to catch up with their orders. On May 1 they move their offices from New York to their factory in Brooklyn. The factory is at the corner of Jay and Plymouth streets, only five minutes' walk from the end of the big bridge.

Standard Underground Cables.—Mr. G. L. Wiley, the active and successful representative of the Standard Underground Cable Company, has sold recently 65,000 feet of cable to the United States Illuminating Company for cable work, and it is now being laid. He has orders from this company aggregating 110,000 feet of single conductor cable, No. 4 B. & S. gauge, for the conduits of this city. The Western Union Company has given an order for a 100-wire cable, No. 16 B. & S., to go into the conduits from Broad street to 195 Broadway and Brooklyn Bridge.

The Edison General Electric Company.—A special dispatch from Albany, N. Y., of April 23, says: The certificate of incorporat on of the Edison General Electric Company was filed to-day with the Secretary of State, and the New York City lawyers of the company paid to the State Treasurer $15,000, the State tax of one-eighth of 1 per cent. on the capital, payable by all newly-incorporated companies. This is one of the largest incorporation fees paid to the State for many years. The new company is formed by Henry Villard and Thomas A. Edison and associates to carry out the recently-perfected arrangements for consolidating the Edison electric light and manufacturing companies. The capital stock of the company is $12,000,000.

The National Conduit Manufacturing Company.—Mr. J. P. McQuade, of this company, 18 Cortlandt street, has lately returned from Milwaukee, where he has been superintending the laying of some 5,000 feet of their cement lined iron pipe conduit, for the Western Electric Company, for arc and incandescent lighting. I am informed that the wires of both classes are now working successfully. The great advantage of this system is the perfect dryness of the pipes at all times, being kept so by the cement, which absorbs the moisture. The joints are also constructed so as to withstand any sinking of the ground around the conduit. This system has been adopted for the permanent underground construction of the telephone service in Boston.

Messrs. I. B. Newcombe & Co., of this city, offer for sale o investors a limited amount of the capital stock of the Anglo-American Electric Light and Manufacturing Company. The stock is full paid and non-assessable. The company was organized to manufacture, under letters patent owned by the company, storage batteries or accumulators, which are claimed to be far superior to any other now known in the scientific world. The profits to stockholders will accrue from royalties on State, city and county rights, from the profits on sales of accumulators manufactured and dividends earned by sub-companies through an interest in the stock of such companies. There have been, it is stated, a number of contracts made and executed for subsidiary companies, showing a handsome dividend already clear upo n capital stock of $2,500,000. In order to increase the manufacturing facilities of the company, demanded by its already assured business, this stock is offered for subscription at $5 per share. The privilege of advancing the subscription price without notice is reserved.

Mr. C. Upham Ely, 35 Dey street, New York, has for some years made a specialty of smelting and refining nickel anodes for electroplates, and has met with unprecedented success in producing a fine quality at the lowest possible cost to the purchaser. He has lately added several more specialties to his line of manufactures in dynamos for depositing of the very best workmanship and capable of working to the best advantage in large nickel baths. His buffing machines are made strong, durable and lasting, and the same may be said of his polishing buffs and composition. His very latest addition is a new improved Leclanché battery of his own make, for which he claims long life,—a battery that will recuperate quickly after being left on accidental closed circuit. The price he claims alone ought to sell the battery.

The Dale Manufacturing Company, 90 Fulton street, started in business a few months ago to furnish isolated plants with supplies, including lamps for any system, key sockets, cut-outs, fusible metal strips, dynamo brushes, etc. They are also manufacturing the Dale incandescent switch. This switch gives two breaks of an inch each from contact points. No spring brass is used, and the construction is such that it cannot get hot from loose contact. The capacity in ampères of each switch is stamped on it. It is warranted to carry that amount of current, making a break without injuring the contact points. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, April 27, 1889.

Mr. F. E. Pettingell, of Pettingell, Andrews & Co., left this city for Chicago on the 24th.

Mr. W. R. Caulkins, of the Thomson-Houston Company, has returned from his Southern trip, and is stopping at Young's Hotel.

The Williamstown (Mass.) Electric Light Company will soon commence the construction of its plant, which is to be run by water power.

Middleborough, Mass.—Electrical affairs are quiet here, the smoke of the battle having cleared away. Work will probably proceed again in about a fortnight.

Weymouth Electric Light and Power Company.—The construction work for this company is to be done by the Wright Electrical Engineering Company.

Grant, Pearson & Co., of this city, will soon ship to Cuba a complete steam plant for electric lighting purposes. The McIntosh, Seymour & Co.'s engine will of course be used.

Mr. Fred Swan, formerly with the Boston Electric Light Company, is about to engage in business for himself as electrical engineer. His office will be located at 52 Purchase street, Boston.

Mr. F. E. Berlar, formerly with the Thomson-Houston Company, has accepted a position as mechanical engineer with the Robinson-Foster Electric Railway Motor Company, and is now located at South Peabody, Mass.

The New White Rail.—In your last week's number I noticed a statement to the effect that "It has a central vertical rib." This is obviously a mistake, as it is intended to supersede and be superior to rails having such a rib. The rail is attracting very favorable attention.

Brighton and Cambridge Electric Railway.—The West End Street Railway Company wish to run a double track between the above named places, using electricity as the motive power, and have petitioned the Board of Alderman to that effect. The Board will consider this petition on Monday, May 6.

Ansonia, Conn., has recently had the benefit of a number of elementary lectures. by Mr. C. D. Warner, on the subject of electricity and its modern applications. Speaking about lectures, I notice from an exchange that Mr. H. C. Spaulding, of the Thomson-Houston Company, has delivered an interesting lecture in Scranton, Pa., on certain practical points pertaining to electric power and electric light.

Exeter, N. H.—Nearly one hundred of the leading citizens of Exeter, N. H., united recently in forming a board of trade for that town. Hon. John J. Bell was elected president, and a strong executive committee, as well as one on New Industries, was appointed. It is the purpose of the people of Exeter, through this board, to make the commercial advantages of their town more widely known and to extend substantial encouragement to such desirable manufacturing industries as may locate among them.

Mr. Frank Ridlon is now comfortably installed in his new and handsome offices, and has issued a prospectus of his new business. This has caused some good-natured joking about his being a dealer in "junk, old iron, brass, copper, bric-a-brac, etc." Mr. Ridlon, besides looking after the Baxter motors he has placed in operation, will fill a long-felt want in dealing in all manner of electrical apparatus that has been displaced and is for sale, and in second-hand electrical supplies in general. He already has disposed of several such machines at remarkably low rates, and the trade bids fair to be booming. His prospectus is a masterpiece of conclusive rhetoric.

The Boston Board of Electrical Control.—New England in general, and Boston in particular, is watching the wholesale destruction of poles in New York with calm expectancy. The tone of the daily press here, notably the Boston *Herald*, is dispassionate and fair. This brings to my mind what the Board of Electrical Control in Boston proposes to be, if it ever attains to existence. It is to "regulate in a skillful way the overhead wires, requiring the removal of dead wires, and gradually, *when feasible*, causing all wires to go underground." These are very moderate and, it seems to me, sensible powers, from which one would judge that Boston will never compel an arc light company to place its wires in a conduit not proven, to some extent, a permanent success for that purpose.

Electrical Knowledge for Legislators.—I was surprised and delighted to receive a call the other day from one of this State's well-known members of the Lower House. In the course of a conversation on electrical matters in general and overhead systems of electric street cars in particular, he said: "I have reached a point where it is my duty to know something about these things for myself, and I am going to start at the beginning and work up. From now on for six months I am going to make a specific study of electricity, and as soon as I am able to absorb some of the practical part, am going to take a practical man out of some electrical factory or station and pay his salary while under his instruction. The time must soon pass when we (the Legislature) are to be fooled by any electrical sharp that is trying to get a bill through for himself—we must be posted ourselves." Verily, the world do move!

Thomson-Houston Motors.—The Thomson-Houston Electric Company report the following sales of stationary motors: 7.5 h. p., Walker & Pratt Manufacturing Company, Boston; 1 h. p., J. H. Kelly, Providence, R. I.; 10 h. p., Georgia Electric Light Company, Atlanta, Ga.; 10 h. p., Master Builders' Association, Boston; 1 h. p., A. Harris, Providence; 1.5 h. p., Bonschur & Holmes, Philadelphia; 3 h. p., H. W. Ladd, Providence; 1.5 h. p., W. Shedley, Providence; 10 h. p., J. J. Hillman, Boston; 15 h. p., Garfield & Proctor Coal Company, Boston; 1 h. p., Cambridge Shirt Company, Cambridgeport, Mass.; 1.5 h. p., A. C. Manchester, Providence; 1.5 h. p., New Bedford Gas Company, New Bedford, Mass.; 3 h. p., C. F. Heptonstall, Providence; 1 h. p., B. F. Haley, Dover, N. H.; 1.5 h. p., John M Sweeney, Wheeling, W. Va.; 3 h. p., E. L. P. Martin, Providence; 5 h. p., T. C. Entwistle, Lowell, Mass.; 15 h. p., Minot Estate, 39 Court street, Boston; 20 h. p., Whittier Machine Company, Boston, two motors for elevators; 5 h. p., Thomson-Houston Electric Light and Power Company, Buffalo, N. Y.; 10

h. p., Wales Manufacturing Company, Syracuse, N. Y.; 5 h p., St. Catherines Electric Railway Company, St. Catherines, Ont.

An Elevated Road for Boston.—Will Boston, the focus of culture, the queen of ethical development, be the first city to establish a system of elevated railroads which shall be exclusively electric, and which perhaps may possess other features of construction novel and startling? I don't know, but the little "dicky birds" who are conversant with the tendency of present legislation hint at about as much. Boston does not want noise, it does not want smoke, coal dust, ashes and all the other adjuncts of the ordinary elevated railway. The æsthetic eye will probably have to put up with some kind of an elevated structure in the near future, but the prevailing sentiment is against the most objectionable features of the New York roads, and deprecates, to a large extent, steam as a motive power. The recent Western trip of the Boston Board of Alderman, inspecting electric railway systems throughout the United States, may have a decided bearing on this subject.

Thomson-Houston Lighting Business.—The Thomson-Houston Electric Company report the following sales of arc and incandescent lamps: Adams, Mass., 45 arc ; Sanford Woolen Mills, Medway, Mass., 100 inc. ; Monroe County Insane Asylum, Rochester, N. Y., 600 inc.; Saxon Woolen Mills, Franklin, Mass., 200 inc. ; New England Company, Bath, Me., 300 inc. ; Buffalo, N. Y., 190 arc; Lowell, Mass., 1000 alt.; Leominster, Mass., 50 arc, 600 alt.; Leicester, Mass., 600 alt.; Hudson, N. Y., 45 arc; Portland, Me., 45 arc; Manchester, N. H., 100 arc ; Revere, Mass., 600 alt.; Findlay, O., 1,000 alt.; Woonsocket, R. I., 1,000 alt.; Pitman, Mass., 500 alt., 50 arc; Rockland, Me., 30 arc; Savannah, Ga., 250 arc; Malden, Mass., 500 alt; Upper Sandusky, O., 60 arc; Columbus, Ga., 1,000 alt., 100 arc; Thomasville, Ga., 50 arc; Perry Paine Building, Cleveland, O., 1,000 inc.; Falls City Jean and Woolen Mill, Louisville, Ky., 200 inc.; Stearn & Silverman, Wheeling, W. Va., 20 arc; Mowry Building, Syracuse, N. Y., 200 inc.; New Haven, Conn., 45 arc; Washington, O., Court House, 50 arc; Cambridge, Mass., 1,000 alt; Hudson River State Hospital, Poughkeepsie, N. Y., 800 inc.; Bedford, Pa., 50 arc, 600 alt.; Stamford, Conn., 1,500 alt.; Fernandina, Fla., 50 arc; New Decatur, 50 arc; Chester, Pa., 30 arc; H. W. Smith, Bangor, Me., 50 inc.; T. Ala., J. Stewart, Milo, Me., 50 inc.; Riverside & Oswego Mills, Providence, R. I., 400 inc.; Morse & Whyte, Cambridge, Mass., 200 inc.; Jewell Milling Company, Brooklyn, N. Y., 200 inc.; James Walker & Co., Basin Mill, Me., 50 in.; Fort Payne Coal and Iron Company, Fort Payne, Ala., 400 inc.; J. B. Mason, Providence, R. I., 50 inc.

The Consolidated Electrical Association of Maine.—I clip the following from the Bangor, Me., *Industrial Journal*: "The Consolidated Electrical Association of Maine was organized last season for the purpose of doing a general electrical business all over the State The association was incorporated in June and it succeeded to the business of the Electrical Accumulator Company, which had been organized during the previous March. The office of the association is in the Mount Desert Block, Bar Harbor, and its officers are as follows: President, Geo. H. Grant; treasurer, H. W. Ladd; electrician and manager, Luther A. Leach. President Grant has been associated with the telegraph business since 1872, with the telephone business since 1880, and with the electric light business since 1886. He was the senior member of the banking firm of Grant, Lyman & Co., which has since been succeeded by the Bar Harbor Banking and Trust Company. Treasurer Ladd has for five years been engaged in the banking business as cashier, while Manager Leach has for a similar length of time been associated with the electrical business. The Consolidated Electrical Association, of Maine, controls the Ellsworth Electric Light Company, the Bucksport Electric Light Company and the Hancock County Telegraph and Telephone Company. The association has a mill at Bucksport where are manufactured cross-arms, cleats, rosettes, cut-outs, and all the woodwork used in the business, the mill being in charge of Charles S. Homer. The association put in its first plant in Cherryfield last June, and at Brunswick the following July, the results in each case being highly satisfactory. The next plant put in was at Camden, from which excellent reports come. Other places in which the system has been introduced are Dexter, Ellsworth and Bucksport. In Bucksport the pant factory is run by electricity, and at Ellsworth a foundry and machine shop, and probably the new shoe factory, will be operated by electric power. In Bar Harbor batteries are now being put in to light cottages, hotels and other buildings. The Bar Harbor *Record* printing press is to be run by electric power and also Asa Hodgkins' wood-working mill, the motor employed being of 10 h. p. The Brunswick station is in charge of C. B. Story, who for 17 years has been in the electrical business and is a selling agent for the Consolidated Electrical Association of Maine. Among the contracts the association now has on hand is that of lighting the streets and avenues of Sorrento. The Consolidated Electrical Association of Maine is prepared to furnish and install all kinds of electric light and power plants. The association has the sole ageney for Maine of the Electrical Accumulator Company, 44 Broadway, New York City, and the latter company's storage batteries are furnished in connection with any system of electric lighting." W. I. B.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, APRIL 25, 1889.

The City of Bainbridge, Ga., is to have electric light.

A New Motor Line is projected from Anoka to Minneapolis.

Mr. Charles J. Van Depoele, now with the Thomson-Houston Company, at Lynn, has been in town the past week.

Fire Alarms in Olean, N. Y.—An appropriation has been made amounting to $25,000 to establish an electric fire alarm system in Olean.

An Artistic Time Table.—The Des Moines Electric Railway have gotten out a new time table, which for neatness and durability is unsurpassed.

An Electric Railway in Minnesota.—An electric railway is under process of construction at Stillwater, Minn., and two miles of track has been laid.

Mr. D. B. Perry, Treasurer of the Sperry Electric Company, is confined to his home by a severe accident, although it is not expected that the consequences will be serious.

Electric Lights for Photographing.—A 6,000 candle-power focusing light, and one Sperry dynamo, have been sold to a leading local photographer for photographing purposes.

The Duluth Electric Light and Power Company are about to make a large increase in their plant; they have ordered a new incandescent dynamo with a capacity of eight hundred lights.

Phonographs in the West.—The Colorado and Utah Phonograph Company has been incorporated in Denver, with a capital stock of $250,000. The incorporators are T. B. Dunbar, E. W. Rollins and Z. T. Edson.

Lights for Louisville.—Following up several other improvements in Northern Kentucky, it is proposed to light the city of Louisville by electricity, and the city corporation has advertised for proposals from electric light companies.

Another Electric Coal Digger.—The Bessemer Coal Company have put into their mines at Summerville, Ill., it is said, a 50 h. p. Westinghouse motor, which they will use to operate a coal drill, which is the invention of Mr. J. Smith, one of the miners.

The Merchants' Electric Light and Power Company, of Birmingham, Ala., has completed its new plant, and will begin furnishing light and power about the 1st of June. The city wiring will be finished in about ten days. The company will start with 80 lights.

The Elevated Railroad at St. Louis.—The Broadway and Seventh street electric elevated passenger railway of the city of St. Louis is now all but a settled fact and work of organization is being rapidly pushed. It is expected that the construction will begin in a short time now.

The St. Louis Lighting Station.—Work is being pushed at St. Louis on the new electric light and power station and it will soon be completed. The plant will cover 30,000 square feet of ground. The Indianapolis Jenney Company, which got the big contract for lighting the city, wants to begin to string wires.

Electric Railway in Wisconsin.—There is very little doubt that the plans of the Milwaukee Cable Railway have undergone a complete change. The superintendent of the construction company states that electricity will be used as the motive power. In the meantime the work of construction is in no way delayed, and the track will be all laid down in a short time.

The Phonograph in Kentucky.—The Kentucky Phonograph Company, of Louisville, has been formed to handle phonographs and place them on the market in the State of Kentucky. They have already ordered a hundred machines. The company has a capital stock of $400,000. H. V. Loving is the president; L. Leonard, vice-president; and Oscar Fenlay, secretary and treasurer. The directors are H. V. Loving, Oscar Fenlay, John S. Martin, L. Leonard, John H. Sutcliffe, W. B. Haldman, and John H. Leathers.

Increase in the Edison Plant at La Crosse.—A new engine and an 800-light dynamo have been installed in the Edison Works, at La Crosse, Wis. This increase takes care of the day light and power. Some weeks ago Mr. Geo. W. Stubblefield, as a stockholder of the old electric company secured an injunction to prevent the transfer of the plant to the Fort Wayne Jenney Company. An answer was filed, setting forth, among other things, that the old company would sell its poles, wires, lamps and other machinery used in street lighting for $24,000. Yesterday Judge Reeves filed a petition modifying the injunction so as to permit of transfer of the part of the plant used in street lighting for the above sum.

Boiler Explosions—The Causes and Remedies.—In an article on the above subject, which appears in the *Iron Trade Review*, Mr. A. J. Wright, manager of the Reliance Gauge Company, of Cleveland, O., makes the following terse remarks: The experience of steam users with Reliance safety water columns is that they whistle for low water about once a month, on the average, even where the best help and most perfect regulations prevail. This may be hard for people without experience with reliable safeguards of this kind to believe, but it is a fact which can be easily demonstrated, and to it is largely due the action of many of the large corporations in throwing out the ordinary combination and equipping all their boilers with these appliances, after learning their value through practical experience. It is clear that the water in steam boilers becomes low oftener than most people suppose, likewise that the boiler is weakened more or less every time it becomes low, and there is no room for doubt that it may ultimately give way with plenty of water in it, and even without the contributory assistance of ignorance, negligence or even over-pressure, in which event it is no less the result of low water than if it had occurred when the water was low. In this conclusion, and the evidence leading to it, may, we believe, be found the true solution of many mysterious boiler explosions. Both the boiler insurance and the safety water columns have a like effect on the employés, which is of the utmost importance. They make those who might otherwise be careless and indifferent, watchful and careful, for any negligence is sure to be reported to the proprietor, either by the inspector or the whistle. This extra watchfulness is of itself of vast importance, and will go a long way toward preventing "mysterious explosions," and solving the problem of safety. W. A. N.

ENGLISH NOTES.

(*From our own Correspondent.*)

LONDON, April 13, 1889.

The Post-Office Telegraphs.—The Postal Telegraph receipts for the year ending March 31 have just been published, and show the same steady growth as was the case last March. The figures for the past three years are as follows: 1886-7, £1,830,000; 1887-8, £1,950,000; 1888-9, £2,080,000. Each year's receipts, it will be observed, surpass those of the preceding year by nearly 7 per cent. I may mention, in this connection, that the Post-Office has lost, within the last few days, one of the ablest and most popular of its officials in the person of Mr. C. H. B. Patey, C.B., who died suddenly of inflammation of the lungs. Mr. Patey joined the Post-Office in 1863, and for the last twelve years had taken an active part in the management of the telegraphic department. He represented the country from time to time at the meetings of the International Telegraph Congress, conducted the delicate negotiations between the Post-Office and the telephone companies, organized the arrangements which had to be made to cope with the increase of telegraphic messages consequent on the introduction of sixpenny telegrams, and up to the moment of his death Mr. Patey was engaged in the negotiations between the Government and the Submarine Telegraph Company. In 1886 Mr. Patey was made a C. B. for services rendered to the State. The popularity of the late Third Secretary may be gauged by the fact that the head of German Imperial Telegraphs, Herr von Stephan, as soon as he heard of the sad event, telegraphed his condolence and asked for full information.

The Electric Light in Paris.—The Paris Municipality which has hitherto distinguished itself by considerable absurdity and narrow-mindedness in its treatment of the question of the introduction of the electric light, has recently promulgated a scale of charges under which the electric supply companies who have just obtained concessions will be obliged to work. This tariff leads to some interesting results. Owing to the large difference of the charges for current when supplied for power purposes and when supplied for lighting purposes, consumers will, in many cases, find it cheaper to install a motor and dynamo and run their lamps in this fashion than to run their lamps direct off the mains. The charge per carcel-hours (!) is to be .045 franc; now taking the carcel as equal 10 c. p., and allowing 3 watts per candle, this charge amounts to .045 franc per 30 watts per hour. On the other hand .45 franc is the price of a horse power hour. The power supplied is therefore in the ratio of 1 to 25, while the charges are in the ratio of 1 to 10. There is, therefore, an ample margin in large installations for effecting a considerable economy by the introduction of a motor and dynamo. I may mention in this connection that M. Popp, who is well known in Europe as an advocate and successful introducer of the compressed-air system of distribution, is said to contemplate a somewhat remarkable system of electrical distribution in the district of Paris which has been allotted to his company. From the large compressed-air station in the Rue St. Fargeau, a special air conduit will be laid to a number of sub-stations, each of which will be equipped with compressed-air engines driving continuous current dynamos. These dynamos are to have a special form of commutator, supplying alternating currents to primary transformers, which are to feed secondary transformers on the consumers' premises. It would be interesting to learn what percentage of the power supplied to the steam engines employed in compressing air at the Rue St. Fargeau ultimately arrives at the lamp terminals.

Earth Returns for Electric Light Circuits.—When it was announced by the London Electric Supply Corporation that they proposed to lay concentric cables with the outer tube to earth, between their Deptford station and the sub-stations in the metropolis, it was fully anticipated that the Post-Office would have something to say in the matter, especially when it was known that the alternating current was to have a potential difference of 10,000 volts. These anticipations have been realized, and on Thursday last, at the Institution of Electrical Engineers, Mr. Preece gave a brief résumé of the investigations recently carried out by him in order to ascertain what disturbances were likely to occur in telephone and telegraph circuits when earth was used as a return for electric lighting purposes. The result of these experiments, according to Mr. Preece, shows that "the use of the external sheathing as part of the conductor in contact with the earth is quite out of the question." A concentric cable was used in these experiments, which was so arranged that the outer sheathing could be insulated or earthed at will. Along this cable a current of 1.3 ampères was sent, alternations being obtained by the use of a Wheatstone transmitter driven at top speed (a frequency of about 80 per second). Telephone circuits were laid in various directions. When earth was used as a return for the telephone circuits, and when the outer sheathing of the cable was also to earth, loud disturbances were heard in the telephones. When complete metallic circuits were used for the telephones, the disturbances were greatly reduced, and when the outer sheathing of the cable was insulated, the disturbances ceased entirely. Similarly when the earth return was used on the telephone circuits, but with the outer sheathing of the cable insulated, the disturbances, although present, were much reduced. Earth conduction was, therefore, the determining causes of these disturbances, and it would seem as if both electric lighting and telephone circuits must be metallic throughout if a complete remedy is to be obtained.

The Electric Light at the Forth Bridge.—As that gigantic undertaking, the Forth Bridge, is now rapidly approaching completion, and the electric lighting plant is already being dismantled, a few details of the installation may probably be of interest. During the progress of the foundation work the electric light proved of great use to the men employed in the caisson chambers, who were working under trying conditions, and were subjected to a pressure of from two to three atmospheres. Siemens' three-carbon differential arc lamps were used, but frequent renewals were necessary on account of the excessively rapid consumption of the carbons. When the superstructure was commenced, it became necessary to re-arrange and add to the lighting plant, which was grouped into three installations. On the south side of the river there were five incandescent light dynamos and six arc light dynamos. At the central pier on Inch Garvie there were three arc light and two incandescent light machines. On the north side of the river there were also three arc light and two incandescent light machines. In all a total of 12 arc light dynamos, capable of supplying 130 1,200 c. p. lamps, and nine incandescent light dynamos capable of supplying 800 16 c. p. lamps. Underground conductors, insulated with gutta percha and jute and cased in a steel wire sheathing with an external serving of jute and compound, were extensively used. After three years' use they had all become more or less defective, and they were then raised and used on the superstructure, being run on timber stagings. The lamps were suspended from light poles lashed to the girders, or were strung direct between guide wires from the bracings. The advantages of the arc light were fully appreciated, but its numerous drawbacks were also conspicuous, the intense shadows proving a source of great danger to men at work in perilous positions. Among the many rival means of illumination employed, the most prominent was the Lucigen light. As your readers are probably aware, this light is produced by forcing creosote oil, in the form of a spray, through a small nozzle by means of air pressure; the flame is about 3 feet long and emits a light of great intensity and diffusive power. Only .25 h. p. is required to maintain air pressure for a 2,500 c. p. light. This illuminant has several advantages over the electric light, but its alleged economy is quite fallacious, the cost per lamp of 2,500 c. p. being not less than 10d. per hour. Moreover, a small quantity of water in the oil instantly extinguishes the light, and in a wind the flickering is very trying. "Sunbeam" lamps were largely used and were much preferred to the Lucigen light. From the beginning operations have been carried on continuously day and night, and the spectacle presented by the bridge when lit up was a very striking one. The dynamos have worked very satisfactorily throughout, and reflect great credit on their makers, Siemens and Crompton.

The Phonopore.—I have recently had an opportunity of witnessing some very remarkable experiments with Mr. Langdon-Davies' "Phonopore," which, as some of your readers may recollect, was first brought to the notice of the electrical world some two or three years ago. Since that time Mr. Langdon-Davies has devoted his attention to the perfecting of those mechanical minutiæ which contribute so largely to the ultimate success of instruments such as the "phonopore," in which there are so many delicate parts to be adjusted before really efficient working can be attained. The "phonopore" is simply an induction coil with one primary and two secondary wires, but it is in the peculiar arrangement of these two secondaries, and the method employed to work ordinary telegraph instruments by means of the "phonopore," that differentiate this particular telegraphic apparatus from any hitherto brought to a practical stage. The primary circuit, which is closed upon itself, contains a battery, a vibrating reed and transmitting apparatus (Morse key or otherwise). Of the two secondary coils one goes to earth, the other to line, each coil having one end free. Between the transmitting and receiving end there is, therefore, no conductive circuit at all, and the "phonoporic" coils at either end of the line may be likened to a condenser having self-induction. To send, say, Morse signals from one "phonopore" station to another, one has only to tap an ordinary Morse key in the ordinary way, and a number of electric impulses, varying with the length of time the key is down, are sent by the action of the vibrating reed around the primary circuit, inducing corresponding vibratory currents in the secondary line wire, which actuate at the distant station either simple "phonoporic" sounders or by means of an ingenious relay called a "transformer" almost every possible form of telegraphic apparatus. Perhaps the chief beauty of the phonopore is the fact that it can be used in close proximity to numerous ordinary telegraph instruments, and that "phonoporic" currents

can be sent over the busiest lines without in any way interfering or suffering interference. The "transformer" alluded to above is constructed somewhat as follows: A soft iron core is wound with two distinct coils, one connected to line and the other closed through a local circuit, containing an ordinary relay and a battery which sends a permanent current round the coil, which is called the "augmenter" coil. Over the pole there is a diaphragm of steel, and close over this there are two vibrating reeds, called "vibrators," secured at opposite ends and resting one upon the other; these reeds form part of the circuit of the "augmenter' coil. When the impulses due to ordinary telegraphic working reach the line coil, they throw the diaphragm into vibration, but not sufficiently to cause it to disturb the "vibrators." When, on the other hand, the regular and rapid "phonoporic" impulses reach the line coil, the vibrations of the diaphragm attain sufficient amptitude to disturb the contact of the "vibrators;" the current in the "augmenter" coil is consequently immediately diminished, and the magnetism of the core is weakened. This releases the diaphragm from its condition of tension and it strikes a smart blow against the vibrators, severing the contact and breaking the local circuit, the relay in which is thus brought into play and the Morse or other ordinary telegraph receiver makes the required signal. The practical value of the phonopore both as a substitute for, and as an addition to, the ordinary telegraph was strikingly shown at the recent demonstrations, when the instrument was worked not only on various artificial lines, but on an actual telegraph line running between London and Derby, a distance of 130 miles. Duplex, diplex, quadruplex, multiplex and harmonic telegraphy are all within the range of the phonopore, and at the present moment Mr. Langdon-Davies is busy adapting it to the Wheatstone high-speed automatic transmitter, experiments having shown that it is perfectly capable of dealing with currents of such high frequency.

The Board of Trade Inquiry.—The Board of Trade Inquiry into the various electric lighting orders applied for within the metropolis by the electric supply companies, was opened on Wednesday last, at the Westminster Town Hall, under the presidency of Major Marindin, R. E. The thirteen provisional orders under consideration will be dealt with "seriatim;" counsel on behalf of the applicants being first heard, then the witnesses will be examined and cross-examined, and finally counsel on behalf of the opposing local authorities will be heard and the applicants' counsel will reply. Since some fifty corporate bodies have acquired a "locus standi," the duration of the inquiry promises to be somewhat protracted, if this deliberate procedure is followed out to the bitter end. When the inquiry was first mooted the Board of Trade were of opinion that a few days would suffice. It is to be hoped that they have by now a more accurate idea of the task they have undertaken. The proceedings were commenced by Mr. Pember, Q. C., who appeared on behalf of the London Electirc Supply Corporation. He argued that the company's financial status was unexceptional and their scheme a most far-seeing one. His company, he said, had no objection to competition, but if it was ruled that only one company was to be allowed on one area, then the London E. Supply Company would oppose all rival applica' tions, contending that their own system was the best. Counsel then proceeded to e patiate upon the advantages and peculiarities of the Deptford Station, which he said was "large and compact." Great stress was laid upon the coaling facilities, the economy effected by concentration and the freedom from complaints of the nuisance created by the noise and vibration of the machinery which would result from the possession of such a site as that at Deptford. To produce sufficient powers to supply 200,000 lights, 408 tons of coal per diem would be necessary, and Mr. Pember left it to the board to imagine the nuisance which would be created in a crowded London parish by a daily procession of over 200 carts, not to mention those necessary for the removal of ashes and waste. Moreover, complaints had been very rife since the Grosvenor Gallery station had been in operation of the nuisance created by the moving machinery, and law suits had only been avoided by the announcement that the London Electric Supply Corporation intended taking their station to Deptford. Such, Mr. Pember urged, were the inevitable concomitants of central stations placed in crowded districts. The Earl of Crawford and Balcarres, chairman of the London Electric Supply Corporation, was then examined. He reiterated most of Mr. Pember's statements with regard to the reasons which induced his company to move to Deptford and the advantages which they claimed for that situation and the alternate-current transformer system. Cross examined by Mr. Cripps, counsel for the Metropolitan Electric Supply Company, Lord Crawford said it was his conviction that it was more economical to supply electric light from one large station than from several small stations. His company had tried modern appliances, and although they were able to avoid smoke, they could not get rid of noise. In answer to a question from a representative of the St. James' Vestry, Lord Crawford said he was of opinion that the application of electricity as a means of motive power would become in a short time quite as much in request as its application to lighting On Thursday Mr. S. Z. de Ferranti, electrician to the London Electric Supply Corporation, was examined. He saw nothing remarkable or extraordinary in the size of the engines of the company; in fact, he was rather disappointed that they had not got larger ones. They proposed, he said, to connect the mains at the Deptford end to earth, but to insulate along the line in order not to disturb telephone and telegraph work. The mains would be concentric with three-quarters of an inch of brown paper and ozokerite between; this insulation had stood a pressure of 1,000,000 volts from a 12-inch spark Wimshurst machine. There was, he said, no motor at present in the market applicable to alternate-current work, but that would not be the case much longer. The loss of potential in the Deptford mains he calculated to be 1-5 per cent. per mile. On Friday, in answer to a question from Mr. Moulton, Q. C., Mr. Ferranti said that the Grosvenor station was not equal to the present demand, and the dullness of the lights was due to the want of steam and nothing else. The inquiry was then adjourned to the next day.

Cheltenham.—The fashionable town of Cheltenham is apparently about to follow the example of Bradford, and start a municipal central lighting station. After the long and tedious process of investigating and interim-reporting so essential in this country before we can hope to induce any municipal body to take any new departure, the Cheltenham town council has empowered its electric lighting committee to invite tenders for the erection of a moderately sized central station to be worked by the corporation. The cause of the "new illuminant" has been championed with considerable enthusiasm and ability at Cheltenham, and the numerous discussions have been conducted with an unusual absence of acrimony. I notice the committee have based their estimate of maintenance and depreciation on the supposition that each incandescent lamp will be burnt 1,500 hours per annum; 500 or 800 hours is the more likely figure.

The Society of Arts' Motor Competition.—As some of your readers may perhaps recollect, the Society of Arts offered in the autumn of 1886 some of the society's medals for prime movers suitable for domestic installations of the electric light and for other purposes. In December, 1886, it was announced that two gold medals would be offered, the classification being intended to include motors of every class, steam, gas and hydraulic. The entries, however, were remarkably poor, numbering as they did only eleven. The trials were consequently postponed; the conditions of entry were altered, and the number of medals was increased to four gold and two silver. Nevertheless, only four engines were finally presented for trial, viz., a Davey-Paxman, compound portable engine of 9 h. p. nominal; a 9 h. p. nominal "Otto" gas engine; a 8 h. p. nominal Griffin gas-engine, and an Atkinson gas-engine of 6 h. p. nominal. At the request of the Society, Dr. J. Hopkinson, Prof. Kennedy and Mr. Beauchamp Tower accepted the office of judges, and the trials were carried out in September last. The award of the judges, accompanied by a most elaborate and exhaustive report, has now been issued, each of the four competitors being given a gold medal. This is a somewhat lame conclusion to this competition, of which great things were anticipated; the report, however, is of the utmost value, and it is not too much to say that, as regards gas engines, no such complete and impartial tests have ever been made before. A few figures with regard to gas-consumption and mechanical efficiency may, therefore, prove of interest. The "Otto" engine which receives an impulse every fourth stroke, consumed 20.76 cubic feet of gas per indicated H. P. H., and 24.1 cubic feet per B. H. P. per hour, and attained a mechanical efficiency of 86.1 per cent. The Atkinson engine, which also receives one impulse at every fourth stroke of the piston, consumed 19.2 cubic feet of gas per indicated H. P. H., and 22 cubic feet per B. H. P. per hour, the mechanical efficiency being 85 per cent. The Griffin engine has a six-cycle arrangement, but, being double acting, an impulse is given to the crank-shaft at every third stroke. The Griffin consumed 22.64 cubic feet per indicated H. P. H., and 28.1 cubic feet per B. H. P. per hour, the mechanical efficiency reaching 80.9 per cent.

THE TELEGRAPH.

France and China.—France and China have agreed to connect the China and Tonquin telegraph lines, and thus establish communication between Saigon and Pekin.

Electric Fire-Alarm System at the British Museum.—A complete system of electric alarms has been fitted at the British Museum by H. Dale & Co., of Ludgate Hill. Pulls with special indicators are arranged in various parts of the building in communication with the firemen's room and with the front hall of the building. Upon any alarm being given, not only are the police and firemen, by means of an annunciator, informed of the situation from which the alarm is given, but by an automatic relay an alarm is also given at all the entrances and in the principal librarian's house. The arrangements have met with the entire approval of the authorities.

THE TELEPHONE.

Milan.—A new central telephone exchange will shortly be opened in the Galeria Victor Emmanuel at Milan. The exchange will be capable of accommodating 3,000 subscribers. The entire service will now be concentrated in this building, and several switch rooms hitherto in use will be closed.

The Telephone in Kansas City.—W. W. Smith, vice-president of the Kansas City Telephone Company, in response to the question what his company would do in case the telephone bill in the Missouri Legislature passed both houses, said: "We will go out of business, or else transfer our plant to Kansas City, Kansas, and from there continue to serve Kansas City patrons. It will be an expensive move, however, but the passage of the bill will drive us to it, as it costs more to operate the plant than would be returned by the reduced tolls. We are under a heavy expense continually, and have to be making repairs and improvements which cost a great deal of money. Our plant was damaged $18,000 by the storm last December, and we are called upon regularly to put up new wires, as the coal smoke and soot rots them rapidly." Mr. Smith explained that in case of the removal of the plant to Kansas City, Kansas, the Missouri patrons would be charged the statutory limit to the State line, and then would be taxed an additional amount from there, or practically the company would make their own rates.

THE ELECTRIC LIGHT.

Alexandria, Va.—Bids on electric lighting close May 1.

Corpus Christi, Tex.—J. H. Blumenthal will erect an electric light plant.

Bellaire, O.—The Bellaire Gas and Electric Company has been incorporated, with a capital stock of $150,000.

Danbury, Conn.—It is said that the merchants at Danbury are using oil as a protest against higher rates for gas and electricity.

Louisville, Ky.—The Louisville Electric Light Company have just purchased two 750-light Westinghouse alternating current dynamos.

Norwalk, Conn.—The Norwalk and South Norwalk Electric Light Company has received permission to increase its capital stock up to $60,000.

Bangor, Me.—It is stated that the Bangor Electric Lighting Company will remove its entire generating plant to Veazie, in order to obtain cheaper power.

Vallejo, Cal.—The Vallejo Electric Light Company has been formed by J. A. Rigby, C. H. Hubbs, C. Rounds, F. Brown and others to light up Vallejo.

Rutherford, N. J.—A local Edison company has been formed at Rutherford. Mr. W. H. Smith is the president. The company will begin operations shortly.

Fresno, Cal.—The Fresno Gas and Electric Light Company are enlarging their plant. Mr. L. Leach is president, Mr. E. C. White, secretary, and Mr. S. N. Smith, superintendent.

Columbia, S. C.—The D. A. Tompkins Company, of Charlotte, N. C., have secured the contract for lighting the State Lunatic Asylum for $2,900, and will put in a Westinghouse plant.

Manchester, N. H.—The Manchester Electric Light Company, Manchester, has set up two high pressure boilers, 72 inches in diameter, designed by the Hartford Steam Boiler Insurance Company.

Du Bois, Pa.—Mr. J. L. Fisher, general manager in Pennsylvania for the Silvey Electric Company, of Lima, O., is to put in a Silvey plant at Du Bois. He has secured a franchise for Phillipsburg.

Desdemona's Candle.—The candle in Othello and Desdemona's bedroom in "Othello," now being played at La Scala, Milan, is an electric light, no other form of illumination being permitted there.

Centralia, W. T.—The Centralia Electric Light and Power Company has been formed by W. E. Partridge, T. R. Barnum, O. H. Romans and others, with a capital stock of $25,000, to light Centralia.

Baton Rouge, La.—The Baton Rouge Gas, Electric Light and Power Company has been formed by the consolidation of the Baton Rouge Electric Light and Power Company and the Baton Rouge Gas Company. The capital stock is $60,000.

Upper Sandusky, O.—The electric light company just formed at Upper Sandusky will put in a Thomson-Houston arc plant, to be in operation by May 15. Mr. M. H. Brinkerhoff is the president of the company, and Mr. W. Clark, secretary.

Pittsburgh, Pa.—The charter for the People's Light and Power Company, of Pittsburgh, has been filed in the Recorder's office. The capital stock is $10,000, divided into 200 shares, at $50 per share. The directors are John E. Ridall, Willis L. Eaton and Theo. Kloman.

Birmingham, Ala.—The Merchants' Electric Light and Power Company, of Birmingham, will have its plant of 80 arcs of the Ball system in operation by May 1, and will add 1,000 alternating incandescents this fall. It is also the intention of the company to put in an electric railway during the summer.

Williamstown, Mass.—The Williamstown Electric Light Company, of which Charles S. Cole is president and Clarence M. Smith secretary and treasurer, has purchased of Judge Danforth the Valley mill privilege and sufficient land for the establishment of a plant, on which work will be begun at once.

The American Company.—The interest which the American Electric Light Company had on Jan. 25, under an agreement with the Fuller-Wood Electric Light Company, was sold in New York on April 25, on the Real Estate Exchange, to J. W. Hinckley, for $500. The sale was made by order of Receiver J. L. Williams.

Westerly, R. I.—A special dispatch from Westerly of April 17 says: Sealed proposals for lighting the village by electricity were opened yesterday. The conditions were that there should be at least 12 and not more than 20 arc lights of 1,200 c. p., and at least 75 and not more than 125 incandescent lamps of 25 c. p. The Westerly Gas Light Company made a bid of $59 for the former and $11.80 for the latter, and was awarded the contract.

Madison, South Dakota.—The Madison Electric Light, Heat and Power Company are installing a Thomson-Houston plant of 30 arcs and 650 alternating incandescents, with all the latest improvements. The indications are that the company will soon run up to its full capacity. The meter system is to be introduced for residences. The city has a population of 3,000, and has no other illuminant than kerosene oil. The franchise runs for 15 years. The capital stock is $25,000, and $50,000 authorized. Mr. W. H. Jones is president; G. D. Winter, vice-president; S. A. Jones, secretary, etc., and H. Jones, superintendent of construction.

Sing Sing, N. Y.—Some time ago the President of the Board of Trustees of Sing Sing village was served with a temporary injunction, issued by Judge Dykman, restraining the trustees from executing a contract for gas with the Sing Sing Gas Company. The Electric Light Company offered to light the village for $18 per lamp per year, while the bid of the gas company was $25 per lamp. The trustees claim that they could not wait for the Electric Light Company to erect their poles and wires and awarded the contract to the gas company. The Electric Light Company claimed that this action of the trustees was illegal, inasmuch as the Electric Light Company had put in the lowest bid, and it brought the injunction proceedings. On April 22 the matter came up before Judge Dykman, when arguments were submitted as to whether the injunction should be permanent. The Court reserved its decision.

A Railway Wrecking Plant.—A special dispatch from Batimore of April 21, says: The Cumberland Valley Railroad Company has just completed at its shops at Chambersburg, Penn., a movable electric light station of wonderful illuminating power and a novelty in railroading. It is intended to furnish light for wrecking purposes. The main car is 33 feet long by 9 feet wide, and 13½ feet high. The floor is of iron. In one end is a 40 horse-power vertical boiler and a 35 horse-power vertical automatic engine. The engine and boiler rest upon a cast-iron floor-plate, 9 by 11 feet. In the other end of the car are two dynamos, one of 25 lights, the other of 15 lights, both of 2,000 c. p. The dynamos are connected by belting with the engine. In the car are also folding beds, closets, and all the conveniences for operating the plant. Under the car the lamps are carried, and also the tools for erecting the line. Attached to the car is a tender, to supply water and coal for the engine. Upon the tender are racks for carrying the poles, hoods for lamps, and a reel for holding the wire. The poles are made of hollow iron piping of a handy and convenient pattern. The car will form a novel auxiliary to the equipment of the road, and it has attracted much attention from railroad men.

APPLICATIONS OF POWER.

Raleigh, N. C.—It is stated that the Raleigh Street Railway Company have decided to adopt electricity.

Dallas, Tex.—The Queen City Electric Street Railway Company of Dallas is asking for permission to operate along certain streets.

Vicksburg, Miss.—The Vicksburg Street Railway Company have decided to operate their road by electricity, and are now in the market.

Louisville, Ky.—The Central Passenger Railroad Company are putting in eight cars for an "overhead" road of the Thomson-Houston system.

San Antonio, Tex.—The Fort Worth Loan and Construction Company have bought the San Antonio Street Railway, and will operate it by electricity.

Utilizing Niagara.—The *Times-Republic*, of Buffalo, comes out in favor of the Hamilton scheme of utilizing Niagara, which it regards as meritorious and feasible.

Gainesville, Tex.—The Fort Worth Loan and Construction Company have bought the Gainesville Street Railroad which they will extend to ten miles in length and run by electricity.

Attleboro, Mass.—Work on the new electric street railway, to be operated from Attleboro to Plainville, through North Attleboro, Mass., has begun. It is expected that the line will be in operation by June or July.

The Sperry Electric Mining Machine Company has been organized at Chicago, Ill., with a capital of $100,000, to manufacture electric mining machinery. The incorporators are Albert L. Sweet, Elmer A. Sperry and Francis W. Parker.

Americus, Ga.—The Americus Street Railway Company has been organized with Jno. B. Felder, president; W. B. Harrold, vice-president, and W. E. Murphy, secretary, to build an electric

railroad eight miles long. The capital stock of the company is $50,000.

Omaha.—Capt. Eugene Griffin states that on the Thomson-Houston road, between Omaha and Council Bluffs, the cost per day per car for fuel at the generating station is only 28½ cents.

Steubenville, O.—The Steubenville *Herald* speaks highly of the operation of the Sprague road, which has an equipment of five cars, and congratulates Superintendent Davids upon his work. The people have appreciated the efforts of the management by largely increased patronage of the road.

Paris.—MM. Tschierer and Fuchs, of Puteaux, have recently established a central station at 18 Rue Beaubourg, for the distribution of power by electricity. The plant, says the *Bulletin de l'Electricité*, comprises a 110 h. p. horizontal Corliss engine and two Gramme machines, giving 370 ampères and 110 volts.

Providence, R. I.—At the last meeting of the Providence Commercial Club, the subject of "Electricity as a Motor" was discussed before that influential body, by Dr. Louis Duncan, Capt. Eugene Griffin and Mr. Wm. Bracken, who made a decided impression with their statements of principles involved, arguments and statistics.

PERSONALS.

Mr. H. W. Quinby, of the Wilmington, Del., Electric Company, goes to Seattle, W. Ty., to take charge of a plant.

Mr. Henry Edmunds, of W. T. Glover & Co., of London, England, is on a visit to this country. He expects to be here only a few days.

Mr. L. H. Mosely, who died recently at Poughkeepsie, 87 years old, was a prolific inventor, who tried his hands at electric motors as far back as 1837.

Mr. W. H. Forbes has joined the forces of Woodbridge & Turner, the electrical engineers, of this city. Mr. Forbes has been connected with the Sprague Company for some time and is well known in connection with its railway work, having carried out some very creditable installations. Woodbridge & Turner have just secured the contract to equip the Sprague road for Marlboro, Mass.

Mr. J. F. Butterworth, representing the excellent English technical journal, *Industries*, is now in New York, on his way home to England from Australia and the Far East.

MISCELLANEOUS NOTES.

Martin's Ferry, O.—The Martin's Ferry Construction Company has J. Armstrong as president and W. R. Ratcliff as cashier.

The United States Volta Electric Battery Company has been organized at Portland, Me., with a capital stock of $2,000,000, to do a battery business. Mr. G. L. Clark is the president, and Mr. N. C. Woodworth, treasurer.

Massachusetts Institute of Technology.—Entrance examinations for the Institute will be held in this city May 30 and 31, at the Fifth Avenue Hotel, in charge of Prof. D. R. Dewey. Address until May 29, the Institute.

Baltimore, Md.—The Southern Electric Company has been incorporated by J. F. Morrison, D. Howard Tuxworth, Frank S. Marr and others for the manufacture of electrical machinery, erecting plants, constructing overhead and underground lines, etc. The capital stock is $100,000. The company already has a well-known name in electrical circles, and has done a large quantity of business.

A Point for Patentees.—A special dispatch from Detroit of April 12 says: "An important decision was rendered in the United States District Court yesterday by Judge Brown. Asa W. Straight, the inventor of a burner for a gasoline stove, upon which he had applied for a patent, brought suit for an injunction against Clayton & Lambert, who had improved Straight's burner, claiming that the device 'patent applied for' on his burner protected him. Judge Brown held that the device is no protection, and the court cannot grant an injunction, as it cannot assume that the patent will be granted by the Commissioner. He further says that patentees have no rights at common law, and the statute makes the life of a patent 17 years. To grant such an injunction would be to give the patent more than its statutory life, for, if granted at all, it might not be for months after the application was filed. The bill was, therefore, dismissed for want of jurisdiction."

The Forthcoming Exhibition at Birmingham.—It is proposed to hold an Electrical and Industrial Exhibition at Birmingham during the months of August, September and October. The list of patrons is most formidable, comprising as it does the Premier and Mr. Joseph Chamberlain, Sir William Thomson, Sir John Pender, Sir Frederick Abel, Mr. Edison and a host of others well-known in scientific and industrial circles. The exhibition will be held in Bingley Hall, and judging from the energy with which the matter is being taken up there seems every reason to anticipate a big success. The electrical section will be most complete, and all the large English firms and numerous foreign firms have announced their intention to exhibit. In fact, the exhibition promises to be the most important of its kind that has been held for some time, and we should think it would be well worth a visit from American visitors on their way to the Paris Exhibition, especially as it lies on the direct route between London and Liverpool. We may add that applications for space were delivered on or before April 15.

BUSINESS NOTICES.

2938 Vernon Ave.,
CHICAGO, Ill., March 20, 1885.

Smith & Shaw Electric Co.—*Gentlemen:* Your closed Cell Pocket Battery is the finest, neatest and most reliable little battery I ever used; economical, cleanly and effective.

HERBERT W. BROWN, M. D.

Patterson, Jordan & Gottfried, 146-150 Centre street, carry a complete stock of brass and iron machine and wood screws cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rod, sheet German silver, sheet brass, machinery, tools, hardware, etc. Electric motor supplies.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

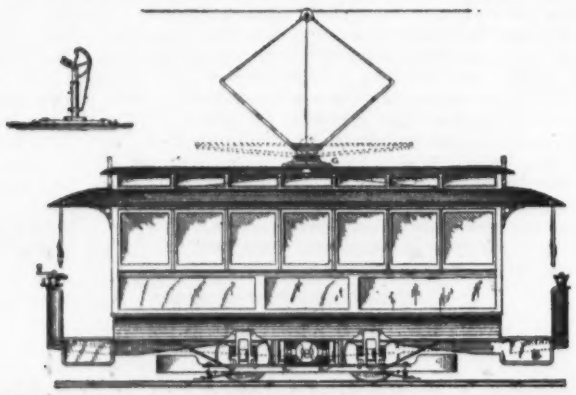
PATENTS DATED APRIL 23, 1889.

401,743. Telephone Transmitter; Webster Gillett, of St. John, New Brunswick, Canada, Assignor to James Straton, of same place. Application filed Jan. 25, 1889. The combination of an insulating base, a diaphragm, separate arc-shaped metallic plates secured to said base, and provided with upright ears disposed in pairs, an insulating cushion on the centre of said diaphragm, a carbon disc on said cushion, carbon electrodes pivoted at their outer ends in said ears, in conductive contact therewith and resting at their inner ends on said disk and electric connections for said arc-shaped plates. See illustration.

401,744. Secondary Battery; William W. Griscom, of Haverford College, Pa., Assignor to the Electrical Accumulator Company, of New York. Application filed Feb. 1, 1889. The invention has particular reference to the arrangement of the plates in the cell, whereby they are supported free from the bottom of the cell in a manner which facilitates the removal of one element without disturbing the other and retains the plates at a uniform distance from one other.

401,761. Combined Motor and Electric Generator; Jabez F. Shawhan, of Dayton, O., assignor of one-half to James W Carpenter, of same place. Application filed March 23, 1888. In a combined electric generator and motor therefor, a frame supporting the field magnets, provided with a hood enclosing the commutator and brushes therefor, a casing between the field magnets and frame enclosing the exposed portions of the armature, and a casing secured to the other end of the frame enclosing the motor connected to the armature shaft, whereby all the operative parts of the generator and motor are protected from exposure. See illustration.

401,789. Burglar Alarm and Testing System; Frank H. Nutter, of Malden, Assignor to Herbert L. Slade, of Chelsea, Mass. Application filed July 9, 1888. This invention has for its



402,117. UNIVERSAL UPWARD PRESSURE CONTACT ARM.

object to construct and arrange an efficient burglar alarm system and to provide the same with testing apparatus whereby every wire of the system may be tested either silently or audibly.

401,796. Electric Railway System; Sidney Howe Short, of Columbus, Ohio. Application filed April 10, 1888. The object of the invention is to provide means whereby the number of poles, arches, or similar ground supports is reduced, and so that the conductors are more nearly parallel with the railway track.

401,797. System of Elevated Conductors for Electric Railways; Sidney H. Short, of Columbus, Ohio. Application filed July 17, 1888. The invention relates to a system of elevated conductors in which the poles are located at a horizontal distance from the railway. The improvement relates to the means of forming a connection between the elevated conductors and the electric cars.

401,801. Commutating Device; David W. Thompson, of Englewood, Ill. Application filed May 29, 1888. The combination of a commutator consisting of a cylindrical metal body having insulating sections extending radially outward beyond the cylindrical surface of the body, and brushes bearing upon said commutator.

401,803. Electric Meter; Elihu Thomson, Lynn, Mass. Application filed Dec. 7, 1888. For description see page 260, this issue.

401,882. Electric Belt; Charles Henry Grimley, of New York, N. Y. Application filed Feb. 5, 1889. A therapeutic electric belt having a series of disconnected batteries composed of a positive and a negative electrode overlapping one another, and an interposed cloth strip, all secured to the web.

401,927. Box for the Distribution of Electric Wires; David Brooks, Jr., of Philadelphia, Pa., Assignor to the Electric Cable Construction and Maintenance Company, of same place. Application filed Nov. 26, 1888. A distributing box for electric wires, consisting of a metallic box screw cap, and provided with side openings of uniform diameter, nipples for said openings, plugs on opposite sides of said box, and ears at the back thereof.

401,936. Electric Conductor; Thomas Egleston of New York, N. Y., Assignor to the Plume & Atwood Manufacturing Company, of Waterbury, Conn. Application filed June 16, 1885. A wire or conductor having applied directly to its surface an insulating-covering of fibrous material impregnated with a liquid fireproofing material, the fibrous material forming of itself the insulating covering for the wire or conductor.

401,953. Secondary Battery; William Prescott Kookogey, of Brooklyn, N. Y., Assignor to the Kookogey Electric Company. Application filed Jan. 28, 1889. A storage battery consisting of a receptacle for containing the electrolyte and a series of pairs of

402,007. SPLICE BOX FOR ELECTRIC CABLES.

positive and negative plates placed horizontally therein, each pair consisting of a positive and a negative plate, placed together with insulating material between them, and the positive plate of each of these pairs being placed on top.

401,970. Electric Motor for Tramway Vehicles; Wm. D. Sandwell, of London, England. Application filed March 22, 1888. The combination, with a tramway, of an electric motor operatively connected therewith, consisting of field magnets and two armatures, the said magnets and armatures being movable, the one with relation to the other, whereby a movement of magnets or armatures reverses the direction of rotation of the armatures.

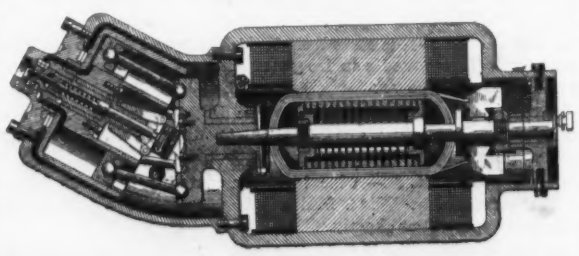
402,006. Secondary Battery; Camille Desmazures, of Paris, France; James L. Norris, Administrator of said Camille Desmazures, deceased, Assignor to Marie Antoinette Desmazures, of Paris, France. Application filed March 31, 1887. Patented in England June 15, 1886, and March 21, 1887; in Germany, March 15, 1887, and in France, May 3, 1887. In an accumulator, the combination, with an alkaline liquid and pure porous metal plates, of parchment paper envelopes for said plates, whereby a metal may be employed whose oxide might dissolve in the electrolyte.

402,007. Splice Box for Electric Cables; Thomas J. Dewees, of Palmyra, N. J., Assignor to the Electric Cable Construction and Maintenance Company, of Pennsylvania. Application filed Feb. 23, 1889. The combination of a cable of electric wires having a spliced joint, a sheath or box inclosing said splice and having packing-receiving sockets at each end, soft packing rings in said socket portions, and couplings screwed into said socket portions and compressing the washer upon the cable. See illus.

402,027. Condenser Switch-Board; William Marshall, of New York, N. Y. Application filed Sept. 29, 1887. For description see THE ELECTRICAL WORLD, Oct. 8, 1887.

402,043. Annunciator Drop; John M. Stuart, of Boston, Mass. Application filed May 22, 1888. In accordance with this invention, two bent arms or pieces are attached, one to each end of a core upon which a coil is wound, or may be formed integral with it, the said bent arms extending toward each other and forming the polar pieces of the electro-magnetic device.

402,064. Switch for Electric Motor Trolleys; Will Christy, of Akron, Ohio, Assignor of one-half to James Christy, Jr., of same place. Application filed Dec. 27, 1888. A switch for electric motor trolleys, consisting of a stem and divergent



401,761. COMBINED MOTOR AND ELECTRIC GENERATOR.

arms, a concavo convex web extending from the point of junction of the stem and arms, and a rib or flange extending longitudinally of the switch and serving to divert the trolley upon, and off of, the branch wires.

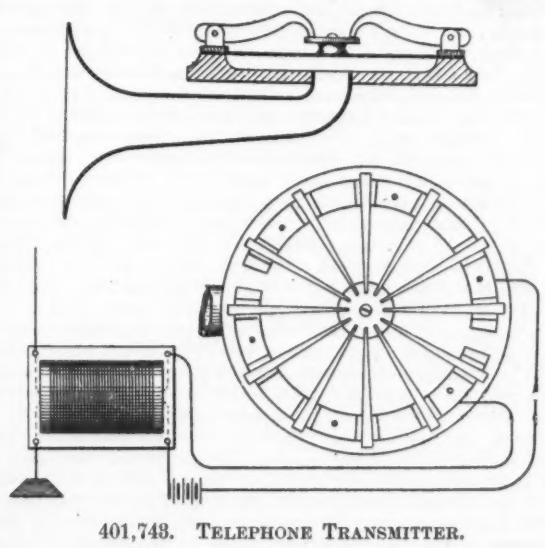
402,066. Dynamo-Electric Machine; Carl Coerper, of Ehrenfeld, near Cologne-on-the-Rhine, Prussia, Germany, Assignor to the Helios Aktien-Gesellschaft für Elektrisches Licht und Telegraphenbau, of same place. Application filed July 19, 1887. Patented in France, June 22, 1887; in England, June 24, 1887; in Belgium, June 28, 1887, and in Italy, Aug. 31, 1887. The cores of the field magnets, as well as of the armatures, are made of a series of thicknesses of sheet iron, which are placed side by side and united by suitable devices, said pieces of sheet metal having notches to receive the wires.

402,080. Electric Car; John W. Henderson, of Philadelphia, Pa. Application filed Jan. 19, 1889. In an electrically propelled vehicle, the combination of two axles, an axle frame journaled upon each axle, a motor-supporting frame hung from said axle frames with provision for lateral movement, and an electric motor supported by said motor-supporting frame.

402,084. Incline Electric Railway; Rudolph M. Hunter, of Philadelphia, Pa. Application filed Jan. 5, 1889. The invention contemplates the employment of an electrically propelled dummy or motor car in a railway having a grade to assist the passenger car (also preferably electrically propelled) up the grade, when provision is made to allow the passenger car to pass the dummy or motor car.

402,099. Printing Telegraph System; Claude Joseph Augustin Munier, of Paris, France. Application filed Oct. 27, 1888. Patented in France, March 9, 1888. The combination of electromagnetic multiple circuit controllers, relays, branches connected with the circuit changers of said relays, and groups of sub-branches connected with the said branches and with the circuit changers of the multiple circuit controllers, so that by the operation of said circuit controllers the branches are completed through a set of sub-branches, and by operation of the relay a circuit is established through an individual branch and sub-branch in the selected group.

402,104. Galvanic Battery; Robert J. Pratt, of Greenbush Heights, New York, Assignor to the Water Primary Battery Co., of Jersey City, New Jersey. Application filed Feb. 27, 1889. A positive electrode consisting of a spirally wound bar of wrought-iron encompassing the porous cell, the convolutions of said spiral being separated from each other by an intervening space, and the



401,743. TELEPHONE TRANSMITTER.

interior of the spiral being also separated from the porous cell by an intervening space.

(1) 402,107, (2) 402,108. Process of Welding Together Sections of Pipe by Electricity. Elias E. Ries, of Baltimore, Maryland, Assignor to Ries & Henderson. Applications filed Feb. 12, 1889. (1) The object is to prevent the formation of a rib or burr on the interior surface of the welded sections, so that such interior surface may remain smooth and unobstructed. (2) The process of welding sections of metal pipe or other metallic articles, consisting in heating their contiguous ends to a welding heat by the action of an electric current in the presence of a fluid-pressure within the said sections.

402,117. Universal Upward Pressure Contact Arm; Charles J. Van Depoele, of Lynn, Mass. Application filed Feb. 19, 1889. In electric railways the combination with the suspended supply conductor and a moving vehicle, of a contact-carrying device suitably supported upon the vehicle and comprising extensible members pivotally connected at the upper ends and provided with a contact device, and a tension spring secured between the lower portions of said members for inclining the members toward each other and elevating the contact device. See illustration.

402,120. Message and Time Recorder; John C. Wilson, of Boston, Mass. Application filed Aug. 20, 1888. The signal receiving instrument and a time stamp comprising a dial and pointer, one of which is continuously movable with relation to the other, a presser, and an electro-magnet for moving the presser, combined with a circuit changing device which at regular intervals effects a change in the condition of the circuit of the said electro-magnet, and a motor mechanism for said circuit changing device.

402,121. Telephone; Edward A. Woelk, of Belleville, Ill. Application filed July 7, 1888. The invention is intended to provide means for effectually and readily opening and closing the local circuit, which forms part of such device.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1865—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co., Ltd.